SCIENTIFIC AMERICAN

A WEEKLY JOURNAL OF PRACTICAL INFORMATION, ART, SCIENCE, MECHANICS, CHEMISTRY, AND MANUFACTURES.

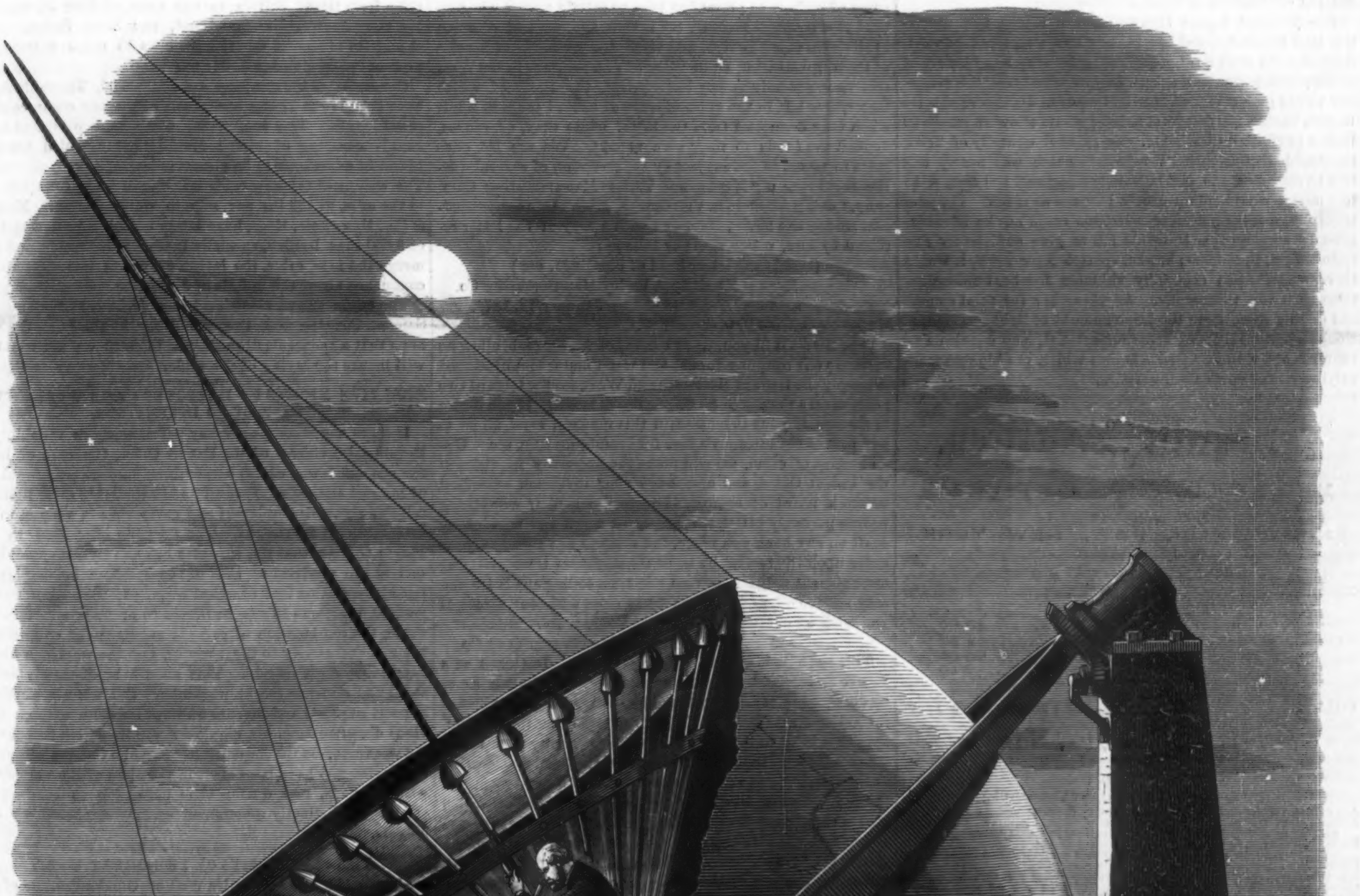
Vol. XXX.—No. 11. [NEW SERIES.] NEW YORK, MARCH 14, 1874. [$3 per Annum, IN ADVANCE.

NEW AND GIGANTIC TELESCOPE.

Among the many ideas which have been elicited by the discussion in these columns regarding a gigantic or "million dollar" telescope, we have recently had submitted to our examination one which seems to us quite novel, ingenious, and, although untried, not unpractical. It is a scheme for a huge instrument, to be built on either the Gregorian or Cassegrainian system, in which the image is first received on a large parabolic mirror located in a position diametrically opposite to the objective in a refracting telescope, thence reflected back to a secondary mirror, which, in accordance with the respective systems, is either concave or convex, and by the last re-reflected to the eyepiece, the tube of which passes through an orifice in the center of the large glass. It is hardly requisite to explain the immense labor and, in fact, almost insuperable difficulties which would be encountered in constructing a reflector of the proposed size—ten or fifteen feet in diameter—of metal, and mounting the same. The great mirror in the telescope in Melbourne, Australia, though but 3·8 feet in diameter and weighing 3,498 pounds, required 1,270 hours of continuous labor to bring it into the last polishing stage, while its adjustment and mounting exacted the nicest engineering skill. In brief, it may be safely asserted that a metallic mirror, of the large size above noted, supposing it could be successfully constructed, would, from its great weight but far more on account of its consequent flexure, be practically useless.

Mr. Daniel C. Chapman, of this city, who is the originator of the plan we are about to describe, suggests both a mode of making a mirror of light weight, and also a method of supporting the same. The reflector, he says, may be constructed of glass. A mold of clay, metal, or cement, of the required shape, is carefully formed and placed in a suitable furnace, cavity upward. Over the latter a huge plate of glass is disposed, and the heat applied. At a certain temperature, the glass begins to soften, and in such state may be bent, fitted into the mold, and subsequently annealed. The whole is then removed and placed on a plane. The glass is taken from its bed, disposed convex side up, and a backing of cement or plaster, the composition of which is previously determined by experiment so that it shall have the same coefficient of expansion as the glass, is applied, to several inches in thickness. The mirror is next inverted, placed on a turning table, and carefully ground or finished within, into the exact form necessary. But little labor, comparatively speaking, will here be required, as an approximate or very nearly true curve will, it is believed, be taken by the glass in fitting itself to the mold. The reflecting face is, lastly, silvered by Dr. Draper's process, a solution of Rochelle salts and nitrate of silver being applied, which very quickly deposits a fine uniform metallic surface. It will be noted that the inventor thus obtains a reflector of light plaster and glass, the weight of which is necessarily quite small.

Next, for its suspension, and this will be rendered clear by the large engraving on our front page: On the rear of the plaster backing are made a number of projections, arranged with sockets to receive the ends of any number of braces. The latter are of wood, strong and well seasoned, and covered with some preserving material. These, extending from various points on the back, meet at the center of a huge copper sphere, which incloses the entire apparatus except the mirror, and then, intersecting, spread again to abut against the interior periphery of the globe. The mode of arranging these stages is, of course, a matter of engineering detail, and will depend greatly upon local



NEW AND GIGANTIC TELESCOPE. DESIGNED BY DANIEL C. CHAPMAN.

circumstances. The shell of the sphere comes, as shown in the engraving, just to the edge of the mirror, but has nothing to do with its support, the braces being solely for this purpose. The secondary mirror is held by two stays, which extend from the circumference of the reflector and meet at a calculated distance from the same. It is not necessary that the reflector be placed at the surface of the globe, but it may be placed at or near the center, leaving an opening of the same size in the globe, with perpendicular sides, thus requiring little or no counterpoise. The standards and stays holding the small mirror may be attached to the extreme external surface of the globe, thus giving a larger base and greater steadiness. The stays toward the poles are so arranged that the lower one is detached when nearing the horizon, in case it should be desirable. By this method there is nothing, as far as we can now see, to prevent the successful constructing and using of a telescope of very large size.

Through the center of the large glass is made an opening, and in this is a telescope tube, suitably jointed and terminating in an eyepiece within the globe at the observer's seat. The situation of the latter is clearly shown in the illustration, and it is suitably supported so as to be always vertical. By this arrangement the observer is constantly located in the right position; and by placing a partition of some non-conducting material between him and the backing of the reflector, so as to leave an intermediate space of four or five inches, a warm room to work in may be gained, and a means of keeping the braces dry provided.

The great sphere pivots in a ring, the axis of which is inclined to point to the pole, and is pivoted at one side in the cap of a single heavy pier. Below the globe is a vault filled with water or other liquid, in which it floats and from which it receives its principal support. It is evident that the motion of the apparatus will thus be susceptible of easy regulation, and may be effected by simple mechanical appliances arranged with counterpoises and governed by the observer. As our object is not to enter into the minor details of this plan, but rather to exhibit the idea upon which it is based, further explanation is deemed unnecessary.

The inventor thinks that a mirror of fifteen feet diameter may be constructed and mounted as we have described. As compared with a refracting telescope with an objective of corresponding size, and a focal length of 200 feet, the refractor would give a sun picture 20 inches in diameter; the reflector, having 100 feet focal length, would show an image 10 inches in similar dimension. In point of quantity of light, compared with Herschel's reflector, which was nearly five feet in diameter, the focal distance being still 100 feet, a 15 foot mirror would gather nearly 14 times as much. For photography, a great reflecting telescope could not be advantageously employed, as it would fail to give sufficiently fine definition of the object; but for spectroscopic work, it would be very useful and especially valuable for heat investigations with the thermopile. As a searcher for faint comets and double stars, from the large amount of light received, it would lead to results of great importance, and enable us to examine and resolve nebulæ before which the highest magnifying power now existing fails.

Scientific American.

MUNN & CO., Editors and Proprietors.

PUBLISHED WEEKLY AT

NO. 37 PARK ROW, NEW YORK.

O. D. MUNN. A. E. BEACH.

TERMS.

One copy, one year	$3 00
One copy, six months	1 50
CLUB RATES { Ten copies, one year, each $2 50	25 00
CLUB RATES { Over ten copies, same rate, each	2 50

VOLUME XXX, No. 11. [NEW SERIES.] *Twenty-ninth Year.*

NEW YORK, SATURDAY, MARCH 14, 1874.

Contents:

(Illustrated articles are marked with an asterisk.)

LAKE TITICACA.

This is the most singular and interesting lake in the world. Situated on the crest of the Andes, it is the highest large body of fresh water; and as concurrent traditions point to it as the spot where Manco Capac, the first Inca, appeared and woke the aboriginal tribes from their long sleep of barbarism and ignorance, it is the historic center of South America. Humboldt called it the theater of the earliest American civilization. On an island within it are the imposing ruins of the Temple of the Sun, and all around it are monuments which attest the skill and magnificence of the Incas. There are also, as at Tiahuanaco and Silustani, the remains of burial towers and palaces, which antedate the crusades, and are therefore pre-incarial.

Lake Titicaca is about the size of our Ontario, shallow on the west and north, deep towards the east and south. The eastern or Bolivian shore, being backed by the lofty range of Sorata, is very high and precipitous. The lake never freezes over, although the temperature of Puno is often 18° at sunrise. Two little steamers of 100 tuns each do a trifling business. Steam is generated by llama dung, the only fuel of the country; for there are no trees within 150 miles. The steamers actually cost their weight in silver; for their transportation (in pieces) from the coast cost as much as the original price. A steamboat company has just asked from Bolivia the exclusive privilege of navigating Titicaca and the Rio Desaguadero to Lago Pampa, with a guaranty of six per cent cost on the capital and a share in all new mines discovered.

Professor Orton, the latest traveler in that region, calls attention to the fact that Lake Titicaca is not so high as usually given in geographical works by about 300 feet. Its true attribute is 12,493 feet, and in the dry season it is four feet less. This fact has been revealed by the consecutive levellings made in building the Arequipa railway just finished, which reaches from the Pacific to Lake Titicaca. The road rises from the sea to Arequipa, 7,550 feet; thence to the summit, 14,660 feet; and then descends over 2,000 feet, to Puno on the west shore of the lake, a distance by the track of 325 miles from the ocean. Pentlandt's estimates of Sorata, Illimani, and other peaks of the Andes, having started from the Titicaca level as a base line, must come down full 300 feet.

SWINDLING PATENT SELLERS.

We have received of late a great number of letters calling our attention to the rapid growth and extension of the frauds perpetrated upon inventors by inducing the latter to forward sums of money, as pretended fees, to certain agents who pretend to sell patent rights. Some time ago, we had occasion to show up these knaves, and warned our readers to beware of them, mentioning an instance of some scamps in the West receiving not only money but models, the latter of which they either left in the express office or behind them in a loft when they decamped from the town, while they, of course, applied the funds to their own benefit. We are led once more to revert to the subject by the reception of several queries regarding a "Mississippi Valley Manufacturing Company," doing business in Vicksburgh, Miss. One correspondent, among the many, favors us with a copy of the letter received by him, which reads as follows:

(Handsome letter head of buildings, etc.)

Mississippi Valley Manufacturing Co.

January 13, 1874.

Mr. —— ——

Dear Sir:—Will you, upon receipt of $1,200 cash, allow us to have your coupling for gas and water mains manufactured to supply the trade of the South and West, for the term of two years upon a royalty of $5.00 per dozen made? If you desire to dispose of your invention in this manner, send $5.00 to pay part of the attorney's fees for examining title, etc. Upon receipt of same, we will make the necessary inquiries at the Patent Office, and also have your invention examined before a board of competent judges, when, if everything proves perfectly satisfactory, we will remit the amount by draft on any bank you name, the same to be subject to your order upon the receipt by us of the necessary transfer. Our arrangement will not prevent you from selling any State you may receive offers for. Comply at once with our terms, if you wish us to take hold of it. Yours truly,

MISS. MANUFACTURING CO.

This swindle is so very palpable that one is almost at a loss to understand how any person can be so foolish as to be deceived by it; and yet another correspondent, who has interviewed an official at Vicksburgh regarding the subject, says that large numbers of letters are constantly sent to the above address. Inquiries, made as to the business location of the recipients of these missives, revealed a little room in a "decayed part of the city," the whole contents of which would not exceed twenty dollars in value. The parties are young men who are leading a fast and dissolute life on the money thus fraudulently obtained. The inventor rarely receives an answer to his letter enclosing the funds. The *Vicksburgh Herald* has also investigated the matter, and remarks: "We have only to say, for the protection of people everywhere, that we have never heard of any such company, and that it exists only in the imagination of the swindlers who are trying to defraud the public." So much for the Mississippi Valley Manufacturing Company. Still another correspondent asks for information concerning the Western Michigan Patent Agency, Grand Rapids, Mich. This very enterprising firm wants only ten dollars and a model, to make the inventor rich. The writers ask if these gentry are related to the scoundrels who were located in Albion, Mich., some time since, and who flourished under another name.

It is curious to note with what alacrity people will risk good money for the chances of a large profit. The same feeling which induces the ignorant to stake funds in lotteries, where the probabilities are all against them, impels others to transmit their cash to persons of whom they know nothing in the hope of thus securing some enormous gain. It may be laid down as an infallible rule that an invention that is really valuable can always be disposed of privately and readily for its full worth, and the owner of the right, fully appreciating this fact, is never beguiled by such dazzling baits as are offered by these swindling agencies. We are perfectly well aware that it is about as hard to show an inventor that his device, when once patented, is of small utility and value, as to convince a mother that her baby is ugly, and both individuals usually resent the imputation in about the same manner. It is these very inventors, however, who, having exhausted every plan to dispose of their rights, snap at the allurements artfully held out to them, and of course are fleeced. The world gives little sympathy, for it laughs at their verdancy in being so readily deceived; but when the trials, the labor, and expense, which these men incur to carry out their cherished ideas, be reflected upon, the subject becomes more one for pity than for derision.

We would once more warn the people against not only the attempts to defraud, above exposed, but against every other they may receive that even appears of similar nature, particularly against specious parties who, for a certain sum, agree to sell a patent and advertise it in some patent journal or other obscure circular or sheet. It is very rarely that these men ever effect a sale; and if they be swindlers, they dare not announce the fact, if they have done so. Indeed, if any of our readers desire to prove for themselves the genuineness of the offers of their correspondents, they have only to write to the latter for the names of reputable persons whose patents have been sold through their agency; and if any be returned personal investigation will soon determine the question of authenticity.

FAILURE OF THE NEW TELEGRAPH LINE BETWEEN EUROPE AND AMERICA.

We are sorry to know that the new enterprise which was intended to secure the opening of telegraphic communication between the old and new worlds at reduced prices, has, according to the latest advices from London, become a failure. The money paid in has been returned to the stockholders. The title of the organization is the Light Cable Telegraph Company, and they have for some time been engaged in winding the wire preparatory to sinking an ocean cable from Great Britain to our coast of New Hampshire, *via* the Azores, Newfoundland, and Nova Scotia. The charge for messages was to have been 50 cents a word, the present rates being one dollar per word.

The capital of the company was $2,000,000. The cable was to have been much lighter and cheaper than any ocean cable of equal length. The conducting wires were protected by a simple covering of tarred Manilla hemp, which has been found by experience to be almost indestructible in salt water. The weight of the new cable was only a little over 700 lbs. to the mile, or 150 lbs. per mile in water. Messrs. Mitchell & Co., Newcastle, Eng., have lately completed a new steamer of 5,000 tuns burden, specially intended to receive and submerge the new cable, the laying of which was expected to commence about the middle of June next.

The engineer and electrician was Mr. Robert Sabine. Sir Samuel Canning was the consulting engineer. We still hope that a reorganization may be effected on a basis that will insure the laying of the cable.

RELATIVE RIGHTS OF EMPLOYERS AND WORKMEN IN RESPECT TO INVENTIONS.

If there were likely to be any permanency or reliability in the official decisions of the Patent Office, the case of interference which we publish herewith, on another page, would be of interest and value. It exhibits in a tolerably clear light the relative rights of employers and employees in respect to the ownership of inventions. The doctrine now held by the Patent Office is that the inventor has the right to avail himself of the mechanical skill of those whom he employs to put his invention into practical form. If the inventor gives general directions to his workman to produce a certain machine, the combination of parts or arrangement so produced belongs exclusively to the inventor, and the workman has no patentable right therein. This should be distinctly understood and remembered by workmen. But when a workman himself suggests and invents an improvement, without previous direction from his employer, the invention belongs to the workman, and the employer has no claim thereon, although the device may have been made in the shop of the employer, with his tools, and during time belonging to him. This should be distinctly understood and remembered by employers.

THE OIL DEPOSITS OF THE GREAT WEST.

About eight hundred miles west of Omaha the line of the Union Pacific Railroad crosses Green River, and the approach to the river is for a considerable distance through a cutting, of from 20 to 40 feet in depth, made in rock. During the construction of the road, some workmen piled together a few pieces of the excavated rock as a protection for a dinner fire, and soon observed that the stone itself ignited. The place thereafter became known as Burning Stone Cut.

The general superintendent of the road, Mr. T. E. Sickels, has caused analyses and experiments to be made with this substance, which proves to be a shale rock, rich in mineral oils, which may be produced by distillation in abundant quantities, say thirty-five gallons to the tun of rock, at the cost of a few cents only per gallon. The oil thus obtained is of excellent quality and comes over in two or more grades one suitable for burning and one for lubrication. Its abundance and cheapness of production is such as to render it certain that the markets of the Pacific coast, and all places west of the Mississippi, will ere long be wholly supplied from these deposits. The oil can be distilled, delivered, and sold at the points indicated, at cheaper rates than the Pennsylvania and West Virginia oils can be transported to the Mississippi.

The deposits in question are supposed to cover an area of territory one hundred and fifty miles long and fifty miles

broad. They overlie the immense coal beds found in that region, and consist of sandstone impregnated with oil. They are supposed to have originated by the absorption of oil by sand, the oil having been expelled from the ancient vegetable growths by heat and pressure, during the original process of coal formation.

These rich oil shales may be loaded directly into the cars from their native ledges on each side of the track of the existing railway, and their possession must ultimately yield an immense revenue to the company.

ENFORCEMENT OF UNAUTHORIZED CAVEAT RULES.

It has heretofore been the practice of the Patent Office to permit the widest liberty to inventors in the matter of their caveat papers. A photograph, a pen and ink sketch, a drawing of almost any kind, has sufficed, and this freedom has always been a matter of much satisfaction to persons engaged in studying and working out inventions.

In the other departments of the Patent Office, the inventor has been subjected to trouble and expense by the introduction of new rules, or the addition of new forms and ceremonies in the obtaining of patents. The one oasis in the Patent Office desert has been the caveat bureau. Here the inventor has always felt that restrictions were to a great extent removed. He was at liberty to block out his papers in the crudest style if he pleased, and, by payment of ten dollars, have them stuffed away into the official pigeon holes, taking an official receipt therefor. He has always known that his chances of receiving official notice of competing applications for patents were improved by having his caveat papers prepared in a clear and careful manner. Nevertheless, in very many cases, he prefers to describe his invention in his own style in the caveat, even if the officials make his lack of time an excuse for their neglect to send him the notice. Even without the notice, he has found the free caveat facilities, heretofore afforded by the Patent Office, to be a real convenience and comfort.

But the Commissioner of Patents has concluded to deprive the inventor of these satisfactions by requiring that, hereafter, all drawings for caveats shall be done according to the red tape rule. Photographs and ambrotypes (which, by the way, are the cheapest, most convenient and best modes of clearly reproducing a new thing) are now excluded from caveats; so are the ordinary pen and ink and pencil drawings, done on common foolscap paper, uniform with the specification. Inventors who wish to file caveats must now furnish drawings or tracings done on the official sizes and separate from the specifications. Few inventors can do this. They must in future employ agents to make special drawings for them, and pay special charges therefor, thus considerably increasing the expenses of the caveat.

We think this enforcement of rules is entirely unnecessary. It is doubtless a convenience to the clerk who files the caveats, and probably the papers look a little better to the official eye, when filed, if all are uniformly executed. But it is doubtful whether the rule will serve any other purpose. It will certainly subject the caveator to increased expense and inconvenience.

In respect to the filing of applications for patents, the law is very specific. It recites that the applicant shall file a full, clear and concise description of the invention, framed in such exact terms as to enable any person skilled in the art to make, construct and use the same. When the nature of the case admits, drawings must be furnished, and also a model.

In respect to caveats, the law contains no such requirements. It reads as follows:

"Any citizen of the United States, who shall have made any new invention or discovery, and shall desire further time to mature the same, may, on payment of the duty required by law, file in the Patent Office a caveat setting forth the design thereof, and of its distinguishing characteristics, and praying protection of his right until he shall have matured his invention; and such caveat shall be filed in the confidential archives of the Office and preserved in secrecy, and shall be operative for the term of one year from the filing thereof; and if application shall be made within the year by any other person for a patent with which such caveat would in any manner interfere, the Commissioner shall deposit the description, specifications, drawings, and model of such application in like manner in the confidential archives of the Office, and give notice thereof, by mail, to the person filing the caveat, who, if he would avail himself of his caveat, shall file his description, specifications, drawings, and model within three months from the time of placing said notice in the post office in Washington, with the usual time required for transmitting it to the caveator added thereto, which time shall be indorsed on the notice. And an alien shall have the privilege herein granted, if he shall have resided in the United States one year next preceding the filing of his caveat, and made oath of his intention to become a citizen."

It will be noticed that the law does not prescribe the supply of drawings or models, but leaves the creator free to make up the contents of his caveat to suit himself. We believe that the Commissioner's stringent rule in regard to caveats is not warranted by law. Rule 97 reads as follows:

"When practicable, the caveat must be accompanied by full and accurate drawings, separate from the specifications, well executed on tracing muslin or paper that may be folded, and of the same size as demanded in drawings for patents."

Under the general powers of the Commissioner, he may doubtless give minor directions as to the size of sheets, etc.; but in ordering that *the caveat must be accompanied by full and accurate drawings, separate from the specifications*, he probably exceeds his authority. We hope the order will be modified so as to bring it within the terms of the law, while granting the utmost possible latitude to the caveator in preparing his papers.

MOUNT SINAI.

The exact location of this memorable spot, sacred in the minds of all Christian people as the place where Jehovah appeared to man in fire; where the Ten Commandments were written by the finger of the Lord upon two tables of stone and delivered to Moses—has always been unsettled. But a Calle telegram announces that all doubt is now removed. Dr. Beke, the celebrated scholar and traveller, gives as the result of his recent expedition the discovery of Sinai and the finding of verifying inscriptions, of which he has made copies. The cable despatch says that the expedition places the holy mountain at "a day's journey northeast of the village of Akaba, Arabia, at an altitude of five thousand feet above the level of the sea."

Dr. Beke has long maintained that Sinai was an extinct volcano, and the correctness of that opinion is now said to be fully confirmed by his personal explorations. Indeed, the Biblical account of the manifestations, which took place at Sinai in the presence of the tribes of Israel, corresponds in several respects to the descriptions given in these modern times of the volcanic eruptions of Vesuvius. In the nineteenth chapter of Exodus the following graphic narrative is presented:

"And it came to pass on the third day in the morning that there were thunders and lightnings, and a thick cloud upon the mount, and the voice of the trumpet exceeding loud; so that all the people that was in the camp trembled.

And Moses brought forth the people out of the camp to meet with God; and they stood on the nether part of the mount.

And Mount Sinai was altogether on a smoke, because the Lord descended upon it in fire; and the smoke thereof ascended as the smoke of a furnace, and the whole mount quaked greatly."

Moses then went up the mount, and the Ten Commandments were proclaimed; the inspired narrator adds:

"And all the people saw the thunderings, and the noise of the trumpet, and the mountain smoking; and when the people saw it, they removed and stood afar off."

Subsequently, it will be remembered, the Israelites forgot their vows and went back to heathenish practices of idol making, and set up a metallic calf. Moses, on coming down from the mount, had the tables of stone in his two hands; and when he saw the molten calf, he threw down the tables and broke them in pieces. Then he broke up the idol, pounded it into fine dust, which he scattered in a brook that came down from the mount. The inspired narrative then tells us how, by prayer, the Lord was appeased, and He commanded Moses to hew out another pair of tables, and take them up the mount, which he did. Whereupon the Lord again wrote out the same ten commandments as at first, and gave the two new tables to Moses, who brought them down from Sinai and put them in an ark which he had made of shittim wood, "and there they be." Deut. X, 5.

It would be interesting to know what kind of stones are conveniently found at Sinai, out of which Moses might have hewn the tables. From their light weight, indicated by his carrying one in each hand, going up and down the mountain, it would seem as though they might have been composed of slate or other laminated formation. We presume that Dr. Beke's report will give full particulars of the geology of the neighborhood, and perhaps tell us something new about the Mosaic stones.

PLEASANT WORDS.

We are receiving so many kind letters of encouragement and approval of our efforts that, while we should delight in returning our sincere thanks individually to each writer for his good wishes, we would but trespass on the good nature of our readers in monopolizing too large a space in columns which might be filled with more generally interesting matter. We trust, however, that we may not lay ourselves open to the imputation of undue egotism by quoting a few of the pleasant words we receive, since we do so more to mark our appreciation of the spirit which prompts them than for the benefit they may secure to us in the commendation which they express:

"I have completed my quarter of a century as a reader of your paper, and a good portion of that time have been a direct subscriber. I thought to do without the SCIENTIFIC AMERICAN this coming year, but it won't work, so I try it another year. I have been trying to find fault with it all my life, and for all I know will continue trying, and so far unsuccessfully," says one correspondent, and a score or so more writers echo about the same opinion. The *Science Record* for 1874 is also coming in for its share of approval. A letter before us says: "It is a perfect storehouse of valuable and instructive information," and another reader tells us that the lady members of his family join with him in thinking it "one of the most useful and interesting books in the library." For all of which very flattering comments we metaphorically disapparel our heads, make our very best bow, and, with conscious unworthiness, return acknowledgments as grateful as they are sincere.

SCIENTIFIC AND PRACTICAL INFORMATION.

TRIAL OF THE WATER WORKS AT ROCHESTER, N. Y.

The water works of the city of Rochester, N. Y., constructed on the Holly system, have recently been completed, and on the occasion of a public test developed a power and capability which may be fairly considered as unprecedented. The machinery consists in two sets of pumping engines, each of four double acting cylinders 9 × 24, each set being arranged to take suction and discharge at eight successive and equal points during the revolution, to give a uniform and steady flow. These supply the mains and pipes for ordinary use and are run by two turbine wheels driven under a 90 foot head. There are also two pairs of double cylinder steam engines, actuating four double acting pumping engines 10½ × 27, a 150 horse rotary Holly engine, and two rotary Holly pumps. The capacity of all is not less than 4,000,000 gallons per hour in the street mains per 24 hours, and 3,000,000 gallons in the same time can be delivered extra, by the steam machinery. The water is taken to the city by an aqueduct from Hemlock Lake. On the occasion of the trial, says the Rochester *Union*, the works succeeded in throwing thirty large streams at one time, to a sufficient hight to be efficacious in cases of fire, reaching an average altitude of 135 feet; one two inch stream was thrown up 220 feet; one four inch horizontal stream was thrown 465 feet; one three inch stream reached an altitude of 285 feet; a four inch vertical stream was thrown 287½ feet; and a vertical stream five inches in diameter was thrown 250¼ feet! These are, indeed, astounding facts. It was, however, in the thirty stream test that the practical usefulness of the system was most clearly demonstrated. The four and five inch streams could rarely if ever be rendered useful for fire purposes, and it is doubtful whether under any circumstances it would be safe to have recourse to them. So great is the force of the torrent thrown from the standing pipes that few buildings in any city would be able to stand up long under it.

A NEEDED IMPROVEMENT IN SUGAR MAKING.

Mr. José Guardiola, of Hacienda, Chocolá, Guatemala, the inventor of several improved machines for sugar making, coffee drying, etc., descriptions of which were some time since published in these columns, forwards us a letter inquiring whether there is any means by which sugar drained in centrifugal machines can, after the operation, be compressed into loaves or square cakes, so as to remain as hard and compact as ordinary sugar loaves drained in the mold. To drain sugar in a centrifugal machine is an operation which takes but a few minutes, and has the advantage of economy of time and cleanliness; while on the other hand purging sugar in molds requires from six to ten days, increased expenses, more buildings, and greater waste. Our correspondent thinks that pressure will not effect the desired result, but we hardly agree in this view. As long ago as thirty years, sugar was pressed in copper molds. In regard to his inquiry above, however, we learn upon investigation that, if the crystals are compressed when damp and the sugar put into a drying room heated to a temperature of 130°, adhesion will be likely to take place.

THE CHILI EXPOSITION.

In relation to the projected international exposition, to be held in the fall of 1875, in Santiago, Chili, our manufacturers would do well to bear in mind that at the present time fully ninety-five per cent of the trade with Chili is monopolized by England, as against five per cent with the United States. The South American Republics undoubtedly offer a great market for our productions, and it would seem, from our geographical position, that the advantages of the same should be to us instead of to Great Britain. The reason is, however, the lack of as extended means of communication between the United States and Chili as exist between Chili and England; but it would appear that, were the limits of trade between the two first mentioned countries enlarged, the facilities for its greater pursuit would necessarily follow. We have received a prospectus of the enterprise, which gives full particulars. Information may be obtained from Mr. Stephen Rogers, Consul for Chili, 249 West 42d street, New York city.

STEAM ON THE CANALS.

The commissioners appointed to examine the inventions submitted as appliances for steam navigation of the canals, and in competition for the reward of $100,000 offered by the State of New York, have made their final report to the Legislature. The committee were not unanimous, owing, as they state, to the ambiguity and extreme stringency of the law creating the commission, and were unable to make the award under the circumstances, and they leave to the Legislature the question of compensation. Mr. Baxter's boat, they admit, distanced all competitors, but it is believed that Mr. Dobbin's device also possesses great merits, so the matter is compromised by suggesting that $35,000 be paid to the first named inventor on his placing upon the canals seven vessels, built and equipped in like manner as the boat tested, and $15,000 to Mr. Dobbin on his supplying three, constructed according to his plan. It seems to be the general opinion that the act providing for the above mentioned sums will be passed and the matter thus ended.

THE RAPID PROPULSION OF FLOATING BODIES.

It has been remarked in England that, on the canals, the boats, when drawn by horses at a considerable degree of speed, float higher in consequence of the oblique action exercised by the water. Impelled at an enormous velocity, floating bodies would merely scrape along the water, like a *ricochet* bullet.

The English Admiralty recently charged Mr. Froude to examine into the phenomenon; and he finds that the laws of the resistance of a plane surface, A, placed in the water under an angle, θ, are the following: $P = 3{\cdot}48\ A\ v^2 \sin.\ \theta$ for a plane deeply immersed, and $P' = 2{\cdot}14\ A\ v^2 \sin.\ \theta$ for a plane placed at the surface. The vertical component is $P \cos.\ \theta$.

An example will render this clearer: A floating body displacing 2,500 tuns, of which the bottom has a inclination of 4 inches to a foot, is given a velocity of 16 knots, that is 26·4 feet per second, and thus causes an emersion of 171 tuns. Substituting the latter number in the formula, the velocity gained will be 7·6 feet per second.

[Christmas Lectures at the Royal Institution, by Professor Tyndall.]

ON THE MOTION AND SENSATION OF SOUND.

It is needless for me to say to the ladies and gentlemen who honor these lectures with their presence, that they are intended more especially for the instruction of boys and girls. As in all other cases where it has fallen to my lot to teach others, I shall endeavor, while avoiding superficiality, to strip the subject of all unnecessary difficulty, and of all parade of learning, and to present it in simplicity and strength to the youthful mind.

The title of the lectures is "The Motion and Sensation of Sound." Now every boy knows what I mean when I speak of the sensation of sound. The impression, for example, of my voice at the present time upon the organ of hearing, is the sensation of sound. But what right have I to speak of the motion of sound? This point must be made perfectly clear at the beginning.

For this purpose I will choose from among you a representative boy, or allow you to choose him, if you prefer doing so. This boy, whom you may call Isaac Newton or Michael Faraday, will go with me to Dover Castle, make the acquaintance of the general commanding there, Sir Alfred Horsford, and explain to him that we wish to solve an important scientific problem. He is sure to help us; he will lend us a gun, and an intelligent artilleryman; and we will make arrangements with this man to fire the gun at certain times during the day. We set our watches together; and now, before quitting him, we ask the artilleryman to fire one shot. We are close at hand, and we observe the flash and listen to the sound. There is no sensible interval between them. When we stand close to the gun, flash and sound occur together.

Well, we quit the artilleryman, warning him to fire at the exact times agreed upon. Let us say that the first shot is to be fired at 12 o'clock, the second at 12:30, and so on every half hour. We quit our artilleryman at half past eleven, descend from the castle to the sea shore, where a small steamer is awaiting us. We steam out a little better than a mile from the place where we have left the artilleryman; and now we pull out our watches and wait for 12 o'clock. Newton at length says: "In exactly half a minute the gun ought to fire;" and, sure enough, at the exact time agreed upon, we see the flash of the gun. But where is the sound which occurred with the flash when we were on shore? We wait a little, and precisely five seconds after we have seen the flash we hear the explosion; the sound having required this time to travel over a little better than a mile.

We now steam out to twice this distance and wait for the 12:30 gun. We see the flash, but it requires ten seconds now for the sound to reach us; we treble the distance, it requires fifteen seconds; we quadruple the distance, and find the sound requires twenty seconds to reach us. And thus, if the day were clear, we might go quite across to the coast of France and hear the gun there. In all cases we should find that the flash appeared at the precise time agreed upon with the artilleryman, which proves that light reaches us in so short a time that our watches fail to give us any evidence that the light requires any time at all to pass through space, while the sound reaches us later and later the farther we go away. I think these experiments give us every right to speak of the "Motion of Sound"

But they also inform us how the velocity of sound has been actually determined. The most celebrated experiments on this subject have been made in France and Holland. Two stations were chosen, ten or twelve miles apart; guns were fired at each station, and the interval between the flash and the report was accurately measured by the observers at the other station. In this way it was found that, when the air is at the temperature of freezing water, the velocity of sound through it is 1,090 feet a second. On different days we should find it traveling at different speeds—as the weather grows warmer, the sound is found to travel faster.

But I must not let you go with the idea that light requires no time at all to pass through space. This great problem has also been solved; and we now know that, while sound moves at the rate of 1,090 feet a second, light passes over the almost incredible distance of 186,000 miles in the same time. Hence, in the distances employed in our observations, our watches were entirely unable to inform us that light required any time at all to pass through space.

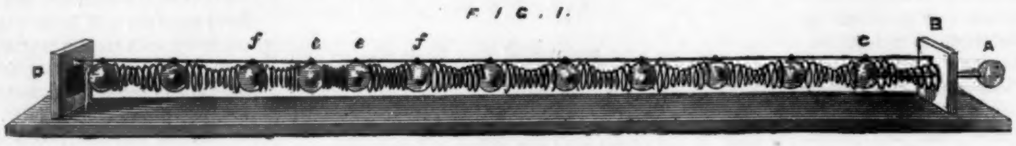
But if I stopped here, your next question would be: What is this thing which passes through the air with a velocity of 1,090 feet a second, and which, when it reaches us, makes us hear an explosion? We must give a thorough and complete answer to this question, but to do this we need a little preparation. Like sailors going into battle, we must clear our decks for action; and here I must ask you to give me your patient and resolute attention.

In order to know how sound is propagated through the air, we must first know something regarding the air itself. Let us examine the air.

First, the air has weight. It presses upon a single square foot of this table with the weight of nearly a tun ($144 \times 15 = 2{,}160$ lbs.) I have here a glass cylinder covered at the top with a sheet of india rubber. The air presses on that surface with the weight of nearly 900 lbs. But then you will ask how the india rubber bears it. Why is it not pressed in? Because air is on both sides of it, and the pressure on the inside is exactly equal to that on the outside. But if I take away the air from the inside of the cylinder, you will soon see the india rubber pressed down by the weight of air above it.

[A tube from an air pump was then attached to a pipe communicating with the interior of the cylinder, which stood on a brass plate, to which its edges were ground parallel; the pump was set in action, and the india rubber diaphragm at once sank down, in the end clinging to the sides of the glass, forming a deep vessel, lining the inside of the cylinder.]

FIG. 1.



When the air is let in again, you observe the rubber returns slowly to nearly its primitive position; it would entirely, but that the india rubber is a little over stretched.

We have thus seen the effect of removing the pressure from the inside. What would occur if we took the outside pressure away? The india rubber would expand. Instead of trying to remove the whole of the air from this room, which is impossible, I will cover these two slack and collapsed bladders with this glass vessel, fitting accurately on to the plate, over which they are suspended; and then draw off by the air pump the air surrounding them. See how they gradually blow out; the folds are now nearly abolished; now they have become quite smooth.

Why is this? Because the air particles have the power of pushing one another apart, and thus take up sufficient space to fill the bladders when the external pressure is removed. The air in this room is pressed upon by the weight of the whole atmosphere. The repelling force which the air particles exert upon each other is called the elastic force of the air.

Now we have to consider how the sound of the gun is propagated through air. Does the gun fire anything through air? No. We may, in a rough way, represent the particles of air by the solitaire balls arranged in a row close together in this groove. I take the first one and roll it against the second. You observe the row does not move, only the end one goes away. The first delivers up its motion to the second, and then stops, the second delivers its motion to the third, the third to the fourth, and so on until the last, which, meeting no resistance, flies off. In this way we may figure the motion as transmitted from particle to particle of the air.

A still better idea may be derived from this model (Fig. 1), which has been devised by the ingenuity of my assistant, Mr. Cottrell.

In my hand I hold a stem, A, passing through the upright, B, by which a shock can be sent from a ball, C, through a spring, to another ball, thence through another spring to another ball, and so on, until at last the shock reaches the last ball, which is projected against the india rubber pad at the end, D, placed there to represent, in a rude mechanical way, the drum of the ear. I press the stem, A, with a sudden motion of my hand, and you see that, though the ball, C, only moves to and fro, yet it sends forward a kind of pulse, *f e e f*, which travels along the line, and ultimately causes the last ball to give a smart stroke against the pad, D.

If you could creep into the tube of the ear, you would find, a little way in, a beautiful fine membrane called the tympanum, or tympanic membrane. The shock of the pulses of air falling on this membrane causes it to shiver; its tremors are transmitted to the auditory nerves, and by them are conveyed to the brain; and cause you to have the sensation which we call sound.

You ought to be able now to figure the way in which the explosion of this popgun is transmitted through the air. I place a ramrod in the tube; there is a cork in the other end; and pushing the rod towards the cork, I cause a crowding together of the particles of air; this they resist, as I can feel by the force I am compelled to exert, and at last their combined resistance takes effect by blowing out the cork at the other end with a sort of explosion.

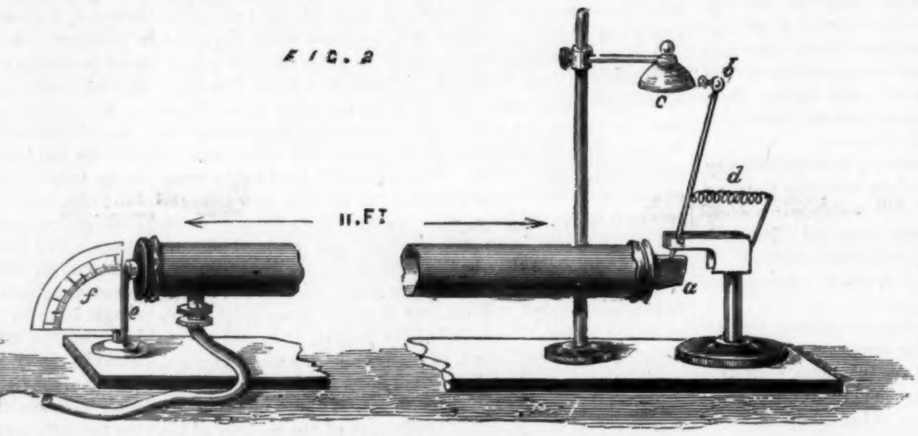
The suddenly expanding air communicates its motion to the air adjacent to it; this again to the air further off; finally the condensed pulse strikes the tympanum of your ears, and you hear the noise. I can show you the passage of a pulse through air in another way. We have here a tube 11 feet long, and about 4 inches wide, its two ends are closed by thin sheet india rubber. Against the india rubber surface at one end a cork gently presses (as in Fig. 2, *a*); to the cork a slender stem is attached, having a little hammer at its upper end, *b*, kept from striking the bell, *c*, against which it abuts, by a slender wire spring, *d*. If now a pulse be sent from the other end of the tube, the india rubber will drive away the cork, and will drive the hammer against the bell. A dull push will not ring the bell at the further end. The particles of air are very mobile and readily slip round one another, so that it requires a sharp shock to generate a sound wave in the tube and make the bell ring outside the tube. I tap sharply with my fingers on the india rubber, and the sound of my tap and the blow of the hammer, upon the bell at the other end of the tube, are audible at one and the same time. This tube is 11 feet long; sound travels through air of the temperature of this room at about the rate of 1,100 feet per second; the time therefore taken by the sound wave, in traversing this tube, is $\frac{1}{100}$ of a second, an interval of time far too minute to be measured by our ears.

Air is therefore a carrier or transmitter of sound. Suppose we remove the air from about a sounding body, will it then be heard? This experiment was made by Mr. Hawksbee, a great many years ago (1705). A bell with a hammer worked by clockwork is placed under a glass globe. From the globe we will pump as much of the air as we can. At present you hear the sound with perfect distinctness; the pumping has at first apparently little effect upon the sound, but very soon it dies away, and now you see the hammer thumping away upon the bell, without producing any noise. It is doing its work in perfect silence. I allow the air to re-enter the glass globe, the tinkling sound of the bell is soon heard, and quickly grows up into the usual musical ring.

We have therefore proved that when the air is removed we have no sound, and when the air returns the sound returns also.

We will now follow the matter up a little further. Professor Leslie found that, when a little air was in the chamber surrounding the bell, and you could hear a little sound, if the space from which the air had been taken was filled up with hydrogen, the hydrogen quenched the sound. Now Professor Stokes has shown us that to create a sound wave in hydrogen a sharper tap is necessary than in air, so that the shock that produces a sound wave in air does not suffice to produce a sound wave in hydrogen (which is a much lighter and less dense gas).

FIG. 2



My assistant, Mr. Cottrell, has devised the experiment I am about to show you to demonstrate this effect.

I have a long tin tube (Fig. 2) narrower than the one I used just now, but having, like it, a piece of india rubber stretched over each open end, with a hammer and bell arranged against one of them, as before; at the other is a cork hammer fixed to a thin strip of steel, which can be drawn back to any given distance (measured on *f* graduated card). I have thus the means of sending a pulse along the tube as before and making the bell at the other end sound, but I now do it by a stroke of measured force. I now let hydrogen into the tube at the end adjacent to the striking cork (by the tube, H), which is a little lower than the other end; and while the hydrogen is entering I continue to send pulses of measured strength along the tube, the bell continues to sound for a little while, but in one minute a sufficient amount of air has been displaced to cause the bell to cease ringing. When we remove the hydrogen, you again hear the bell, showing that the pulse can again be carried from end to end of the tube.

FIG. 3.

Up to this point our illustrations have been audible; I now wish to render visible to you the action of a tube in preventing the dissipation of the sound. The test that I propose to use is a flame. I have behind the table a good sized gas holder, by which gas can be forced through a steatite burner. I light it, and we have that long pointed flame (*a*, Fig. 3), and we shall find that that flame is very sensitive. Chirrup to it, and see how rapidly it answers; a great part of the length of the flame is abolished instantly when the sound wave reaches it (*b*, Fig. 3). I rattle money, tap two keys, and this flame jumps in response to each jingle that I

make. The current of air in the room, owing to our care for your comfort in the matter of fresh air, prevents these phenomena showing themselves as well as they do when the theater is empty; but they are perfectly manifest. No one in this room can hear my watch ticking; but if I hold it near the flame you can distinctly hear the flame give a little roar, and see it suddenly shorten for each tick of the watch. The regularity with which it jumps indicates the regularity with which my watch is ticking.

Fig. 4.

And now observe the action of a tube in preventing the dissipation of sound. Using a less sensitive flame as the sound test, I take off the india rubber ends from our 11 foot tube, and place the flame at the end furthest from myself. The tapping of these two keys together does not affect the flame; but now, my distance from the flame being as great as before, I tap them opposite the open end of the tube, and each tap is rendered, by means of the flame, as visible to your eyes as it is audible to your ears.

Through the unconfined air this small bell does not affect the flame when set ringing; but when I place it at the extremity of the tube, the flame dances to each stroke. Speaking pipes possess their value solely from their preventing the dissipation of the sound pulses; they act precisely as this tube does.

As you know, light cannot well get round a corner; neither can sound, though it does so more easily than light. This little bell acts automatically. I wind it up and start it. At a few feet distance the flame answers to each stroke. Placed behind a board, the flame becomes tranquil. I again bring it out from behind the board, and the flame jumps to each movement of the hammer. (For this experiment the sensitive flame was arranged as in Fig. 4, with a large glass funnel having its tubular end opposite the root of the flame; the board was held about 10 feet distant from the mouth of the funnel.) Sound therefore can be shaded off in the same way that light can be.

In this box, which is well padded, is a bell which I can set ringing at pleasure. The only way by which the sound can get out is this small square opening at one side of it. The bell is now ringing without affecting the sensitive flame (arranged as in Fig. 4); but when this box is turned round, so that its opening faces the quiet flame, we have it dancing and jumping as before.

In other respects also there is a similarity between the mode of action of sound and light.

When a beam from the electric lamp is allowed to fall upon the glass mirror in my hand, it is reflected from the mirror, and, the track of the beam being marked by the dust floating in the room, you can see the direction which it takes. This is in accordance with a well known law, namely, that the angle of incidence is equal to the angle of reflection. It is perfectly plain to you that a line drawn so as to fall at right angles upon this mirror would divide that large angle formed by the two beams of light into two equal angles.

I hope now to make visible to your eyes the eflection of sound in obedience to the same law.

At one corner of the lecture table I place our sensitive flame, *b*, at the opposite corner the padded box containing the electric bell, *a*, with its opening directed in the path taken a moment ago by the beam of light, and I will hold this board, *c*, when everything is ready, where I before held the glass mirror. My assistant will now set the bell ringing. You observe that the flame is uninfluenced by it; but when I bring the board forward, the shortening of the flame at each stroke of the bell proves that the law of the reflection of sound is the same as the law of the reflection of light; the angle of incidence is equal to the angle of reflection. In this case the flame is knocked down by an echo.

We have thus considered the reflection of sound from a plane surface; let us now see if it behaves like light when reflected from plane surfaces.

The beam of the electric lamp is now directed upon the concave mirror. You can see the band of light marked in the fine dust floating in the air; as soon as it strikes the polished surface it is thrown back, but the rays no longer pursue parallel paths, they are converged, thrown together into one spot. By holding a piece of tracing paper at the point where they meet, termed the focus, the brilliant little star of light caused by their convergence is made visible.

Substitute for the lamp a small bell, and for the tracing paper at the focus of the mirror our sensitive flame, and the conditions are the same as in the previous experiment, sound waves taking the place of the waves of light. You cannot see the track of these aerial pulses as you could the luminous ones, but their obedience to the same law of reflection is very manifest by the shortening of the sensitive flame as each sound wave reaches it. The flame, when out of the focus of the mirror, is unaffected; replace it in the spot when the sound waves are crowded together, and it responds to each stroke. Move the bell so that the sound pulses, though only having the same distance to travel to the flame, no longer fall on the mirror; the flame remains perfectly quiet.

We may go further still. Here are a pair of mirrors, the curvature and size of which is the same. They are arranged so as to face one another. A light is placed in the focus of one, that its rays which fall divergent upon the curved surface are reflected from it parallel; they travel to the opposi mirror, and are again converged; a piece of tracing pap held at the focus of the further mirror shows the spot of light as before (Fig. 6).

Sound is reflected in precisely the same way, and the sensitive flame, when carefully manipulated, can be used as a means of proving this fact. For these experiments it is essentially necessary that the flame be reduced to the proper pitch of sensitiveness. By reducing the pressure of the gas we can regulate the flame so that it will not respond unless strongly agitated. The flame is placed in the focus of the mirror, *a*, and when the bell is rung, not being in the focus of the conjugate mirror, there is no action. I now bring it into the focus, *b*, and the flame shows a very strong action. By other modes of experimenting it has long been ascertained that sound was thus reflected from plane and curved surfaces; but never before have these phenomena been made visible. Hitherto these effects have been investigated by the sense of hearing; I have now been able to prove them by appealing to your eyes.

FIG. 5

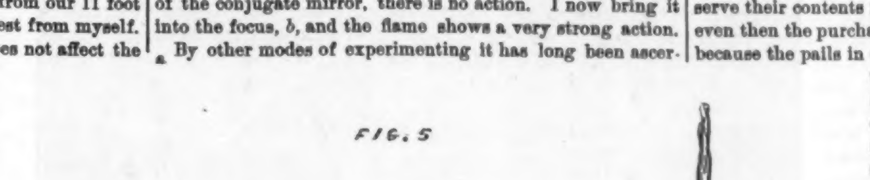


Fig. 6.

New Fossil Man.

In the *Revue Scientifique* for December, it is stated that a third skeleton of a troglodyte has been discovered by M. Rivière in the caves of Mentone. This new skeleton, judging from the various and numerous implements by which it was surrounded, lived at an epoch far more remote than that assigned to the skeleton now in the Museum of Paris. The warlike instruments and objects found with them, though composed of flint and bone, are not polished. They are only sharpened, and by their coarse execution appear to belong to the palæolithic age. On the upper part of the remains was a large number of small shells, each pierced for stringing as a collar or bracelet. No pottery nor any bronze object was found. Our readers may recollect that the first skeleton found in the same neighborhood, on the bank of a railway cutting on the sea margin, appeared to have been crushed by a fall of rock. It was figured in several English journals last year.

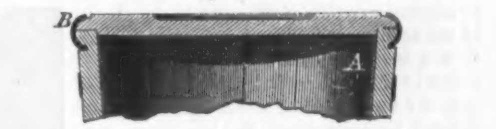
IN a French industrial establishment, employing 630 men, chiefly vegetarians, the sick fund was constantly in debt. By the introduction of meat into the food of the men, the average loss of time per man, on account of illness or fatigue, was reduced from 15 to 3 days per annum.

GILBERDS & HARRIS' RETURN BUTTER AND OYSTER PAIL.

Fresh, sweet butter is appreciated by every one; but however good its quality in the beginning, it will not retain its original flavor unless properly packed in suitable receptacles. Where the butter is exposed to the bad air of damp cellars and dust, it is very liable to become deteriorated, and hence lessened in value while in transit; while butter, packed in good pails, brings from 1 to 5 cents more per pound than when in the common tub or firkin. Similarly good return oyster pails, that hold from 5 to 25 gallons, are found much the cheapest and most convenient way of sending oysters over the country; but these have ordinarily to be locked to preserve their contents from being taken while in transit, and even then the purchaser frequently receives his gallons short because the pails in common use are not tight enough to keep the liquid from slopping over. The pails shown in our engravings are, it is claimed, stronger, tighter, and better adapted to preserve their contents, and stand the rough handling of transportation, than any now in the market. They are made from white oak staves, and are held together by heavy galvanized iron hoops. The covers are of sufficient thickness to allow a flange, A, to extend over the top of the package, while the under side of the cover projects into the pail, as shown in sectional view, Fig. 3. The cover is rounded on its upper corner in form of a quarter circle, and a corresponding quarter circle is cut on the outer edge of the package, the two forming a rib, B, of semicircular or semi-elliptical cross section, with the cover joint along its medial line. A hoop is then swedged in form to fit this rib, except that its edges are a little shorter, while it has strong malleable flanges, shown on the left, in Fig. 1, at each end. A screw passing through one flange into the other is turned by a common screwdriver or key. It will be readily seen that the hoop, when tightened by its clamping device, operates in both vertical and lateral directions, and not only draws the cover down on the package, but strengthens it around the top.

Fig 1 Fig 2

Fig 3



On the oyster pail (Fig. 2) the screw, instead of being slotted, is made and turned by a key; this saves all expense and trouble of locks.

This method of holding the cover is equally adapted for fruit jars or any article having a movable cover. These pails were awarded three first premiums at the New York State Fair, in September last, and also at the Provincial Fair, Canada, and are, we are informed, readily endorsed by all butter and oyster dealers. They are now manufactured by the Jamestown Butter and Oyster Pail Company, at Jamestown, N. Y., to whom all orders should be addressed.

Trout in an Artesian Well.

The *American Journal of Science and Arts* presents the following curious statement: Mr. Bard, the agent of the California Petroleum Company, at San Buenaventura, was lately engaged in constructing a wharf at a point southeast of that place. Wanting water to supply this wharf, he commenced sinking an artesian well on the sea beach, not 5 feet from high water mark. At the depth of 143 feet a strong flow of water was obtained, which spouted forth to a hight of 30 feet. It was controlled with a "goose neck," and utilized. One day, while the agent was absent, the men round the well noticed fish in the waste water. On his return they called his attention to the fact, and on examination the well was found to be filled with young trout, thousands of them being thrown out at every jet. These trout were all the same size (about two inches long) and perfectly developed. The eyes were found perfect. Now there is no stream nearer than the Santa Clara river, several miles distant. Could these fish then, it is asked, have come from its head waters by some subterranean outlet? There are no trout in the lower portions of the stream. The temperature of the well water is 64° Fah

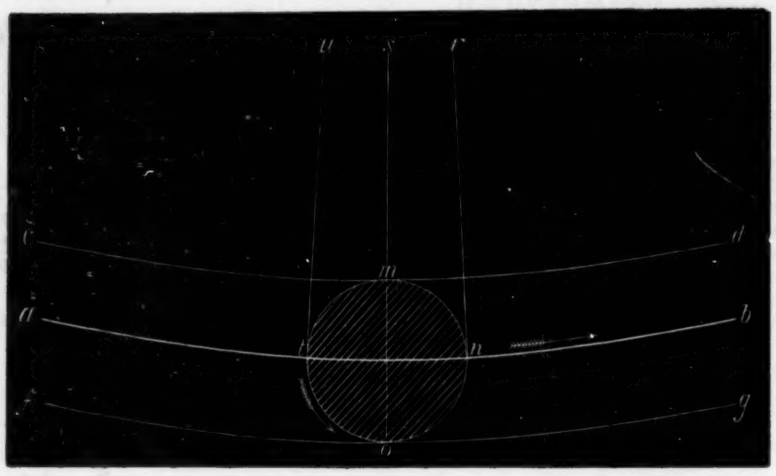
Correspondence.

The Relative Attraction of the Earth and the Sun.

To the Editor of the Scientific American:

The subject of terrestrial and solar attraction having recently been discussed in the SCIENTIFIC AMERICAN without leading to any definite conclusion, I propose to show, by the following demonstration, the exact amount of the solar energy which tends to produce irregularity in the earth's attraction at certain points during the diurnal revolution. Matter resting on the surface of the earth is at all times under the influence of four principal forces, namely, terrestrial attraction, solar attraction, the centrifugal force produced by the earth's orbital motion round the sun, and the centrifugal force caused by the earth's rotation round the axis. In considering the effect produced by these forces on a particle of matter placed on the surface of the earth, the centrifugal action caused by the earth's rotation round the axis may be left out of sight, as it simply tends to diminish the attraction of the terrestrial mass, the diminution being constant at any given point, in whatever position the earth may be placed. Planetary and lunar attraction, it needs hardly be stated, do not appreciably affect the question under consideration. The influence of the three first named forces on matter near the surface of the earth will be readily comprehended by the following brief explanation, reference being had to the accompanying diagram representing a section of the earth in the plane of the ecliptic, and part of the earth's orbit. *o m s* is a straight line drawn through the center of the earth towards the center of the sun, *n r* and *t u* being tangential lines also pointing to the center of the luminary. *a b* represents part of the earth's orbit, *c d* and *f g* being curves parallel to the same, intersecting the central radial line at *m* and *o*.

Mr. Slaughter, in his communication to the SCIENTIFIC AMERICAN, correctly assumes that the weight of bodies on the surface of the earth is not permanent, and that the greatest difference takes place under the meridian, at *m*, and at the opposite point *o*, at midnight; but he has greatly overestimated the energy of the disturbing cause, apparently overlooking the important fact that solar attraction is counteracted by the centrifugal force resulting from the earth's motion round the sun. It needs no demonstration to prove that, unless the sun's attraction on the terrestrial mass was exactly balanced by the centrifugal force caused by the orbital motion, our planet would fall into the sun or retreat from the luminary into boundless space.



Before entering on a demonstration showing the exact difference of the weight of 20,000 pounds (assumed by Mr. Slaughter) under the meridian and at midnight, it will be proper to state the magnitude of the elements on which the demonstration will be based, namely: the mass of the sun, 314,760 times that of the earth; mean distance between the centers of the sun and the earth, 91,430,000 miles; half equatorial diameter of the earth, 3962·91 miles, and mean semi-diameter, 3956·30 miles. Agreeably to the dimensions thus specified, the radii of the curves, *c d*, *a b*, and *f g*, will be respectively 91,426,044, 91,430,000, and 91,433,956 miles. It should also be stated that the writer has recently constructed an instrument by means of which it has been ascertained practically that, at the rising and setting of the sun, solar attraction, exerted on a body resting on the surface of the earth at *n* or *t* (see diagram), is exactly balanced by the centrifugal force acting in an opposite direction called forth by the earth's orbital motion round the sun. The following explanation will give a general idea of the instrument referred to: A solid cast iron ball, eleven inches in diameter, highly polished, is immersed in a bath of mercury, and connected by a fine steel wire to a delicate chemical balance, in such a manner that any attractive force acting on the ball will disturb the balance. The force of gravitation being inversely as the square of the distance, and directly as the mass, the attraction of the sun on the floating ball can be ascertained by the following calculation: 91,430,000÷3,956·30=23,109·9, mean radii of the earth contained in its distance from the sun. Dividing the square of this amount in the sun's relative mass, 314,760, we learn that the sun attracts the ball with a force=0·0005893 of terrestrial attraction. Hence, as the weight of the ball is nearly 181·47 pounds, or exactly 1,270,300 grains, the sun attracts it with an energy of 0·0005893 × 1,270,300=748·6 grains. Careful tests of the new instrument have shown that any pull exerted laterally on the floating ball may be measured by means of the chemical balance applied, provided the force exerted exceeds eight grains. Hence, a difference amounting to less than one hundredth of the energy exerted by solar attraction, or the centrifugal energy resulting from the motion of the ball round the sun, can be readily detected by the adopted device. It only remains to be stated that not the slightest disturbance of the balance has been observed during repeated trials made while the sun has been rising and setting; thus proving that the pull of 748·6 grains, exerted by solar attraction on the floating ball, is counteracted by some other force. For astronomical purposes, the result of the trial can only be regarded as an approximation; but for our present purpose it is abundantly precise, since it takes cognizance of an energy of only 8 grains in 1,270,300 grains, or $\frac{1}{158000}$ of the weight of the body attracted. Referring to the diagram, it will be seen at a glance that the sun's attraction on a particle at *n* acts in the direction indicated by the line, *n r*, while the attraction of the earth on the same particle is exerted at right angles to *n r*; and that consequently solar attraction will not affect terrestrial attraction at the points *n* and *t*. It will be evident, therefore, that, leaving out of sight the constant influence of the earth's axial rotation, the weight of bodies during sunrise and sunset shows the exact amount of terrestrial attraction.

We may now enter on the task of determining the precise amount of difference in weight which results from transferring the supposed 20,000 pounds from *n* to *m*, and from *t* to *o*. Agreeably to the laws of motion, the centrifugal force of equal bodies, moving round a common center at unequal distances in equal times, is directly as their radii. Consequently the centrifugal force of a body at *m*, caused by the orbital motion round the sun, must be less than the centrifugal force at *n*. The difference will be ascertained by dividing the radius of the curve *a b* in the radius of the curve *c d*. Accordingly the diminution of the centrifugal force will be 91,426,044÷91,430,000=1 — 0·9999562=0·0000437. Now the sun's attraction at *m* is greater than at *n*, in the inverse ratio of the squares of the radii of the curves *c d* and *a b*, namely: $91{,}430{,}000^2 \div 91{,}426{,}000^2 = 1{\cdot}0000875 - 1 = 0{\cdot}0000875$. Consequently solar attraction exerted at *m* is 0·0000875 + 0·0000437 = 0·0001312 greater than at *n*, where it is exactly balanced by the centrifugal force caused by the earth's orbital motion. We have already demonstrated that solar attraction at the point *n* is 0·0005893 of terrestrial attraction; thus the supposed weight of 20,000 pounds will be attracted with a force of 0·0005893 × 20000 = 11·786 pounds at *n*. Mr. Slaughter estimates that the attractive energy amounts to 12 pounds 10 drams, the discrepancy being occasioned by his calculation having been based on *data* somewhat incorrect. Solar attraction at *m* being 0·0001312 greater than at *n*, it will be found, by multiplying this decimal fraction by the total attraction at *n*, that in transferring the weight, from *n* to *m*, it will be subjected to an additional attraction of 11·786 × 0·000312=0·001546 pound. Obviously, when the weight is transferred from *t* to *o*, a *diminution* of solar attraction will take place in the inverse ratio of the square of the radii of the curves *f g* and *a b*; while the centrifugal force will be *increased* in the direct ratio of the radii of these curves. Calculation shows that the former is 0·0000865, and the latter 0·0000432. Allowing for the stated increase of centrifugal force, it will therefore be found that the solar attraction at *o* will be 0·0000432 less than at *t* or *n*. Consequently, by transferring the 20,000 pounds to *o*, the solar attraction of 11·786 pounds, exerted on this mass when placed at *t* and *n*, will be reduced 0·0000432 × 11·786=0·000509 pound. The previous demonstrations having established the fact that an increase of the sun's attraction of 0·001546 pound takes place during the transfer from *n* to *m*, it will be readily perceived that a difference of solar energy of 0·001546 + 0·000509= 0·002055 pound will result from the difference of attraction at *m* and *o*. In other words, the weight of the supposed mass of 20,000 pounds will be 0·002055 pound less at noon than at midnight. Agreeable to Mr. Slaughter's computation, the diminution of weight will be 24 pounds 1 ounce, thus upwards of 11,000 times greater than we have established by the foregoing demonstration. Those who do not feel disposed to investigate the subject closely may arrive at a correct conclusion, concerning terrestrial attraction, by simply considering that the gravitating energy is affected by only two appreciable disturbing causes, namely, solar attraction and the centrifugal force resulting from orbital motion; and that these opposing forces are very nearly balanced throughout the entire terrestrial mass, completely neutralizing each other at its center. Likewise that, at all points on the sphere tangential to the sun's rays, solar attraction is exactly balanced by the centrifugal force caused by the orbital motion, a fact practically established by the floating ball of the instrument before referred to. Let it also be remembered that the increase and diminution of the distance from the sun at noon and at midnight amounts to less than $\frac{1}{11000}$ of the earth's distance from the solar center. A moment's consideration, therefore, will show that the disturbing force which modifies terrestrial attraction must be exceedingly small. Again, if such a great disturbance of the earth's attraction existed as Mr. Slaughter supposes, the beat of the pendulum would be so irregular, from hour to hour, during the diurnal revolution, that the most perfect clock would prove a very imperfect device for measuring time. With reference to the proposed employment of heavy weights for ascertaining the variation of terrestrial attraction resulting from solar influence, it should be borne in mind that, by means of the pendulum in combination with the balance wheel of the chronometer, the amount of any appreciable irregularity of terrestrial attraction may be accurately measured. It will be remembered that the present Astronomer Royal of England, many years ago, computed the earth's density by ascertaining the variation of the beat of the pendulum at the mouth and at the bottom of the Harton coal pit, 1,200 feet deep. This depth being only $\frac{1}{17000}$ of the earth's radius, we can judge of the efficacy of the pendulum as a means of measuring terrestrial attraction.

J. ERICSSON.

The Duration of Brain Impressions and the Memory.

To the Editor of the Scientific American:

I have read, with interest, your article on the velocity of nervous impulses, in No. 7 of your current volume; and I am induced by it to ask you whether any experiments have been made to ascertain the length of time required to produce an impression on the mind which will be retained in the memory.

In a case wherein I defended a party indicted for assault with intent to murder, the proof showed that the prosecutor, on whom the assault was committed, was standing in a public road, talking to the father of the defendant about an alleged larceny of hogs, when the defendant approached him from behind, and struck him on the back of the head with the butt end of a gun, and he fell senseless from the blow. A fight ensued between the friends of the parties, in which a number of shots were fired; and after the fight was over, the prosecutor was carried into a yard near by and resuscitated, regaining consciousness in about thirty minutes after receiving the blow. He testified most positively that he had not the slightest recollection of receiving the blow. He recollected and detailed the conversation between himself and defendant's father up to the moment the blow was struck, and also what occurred and what was said when he regained consciousness, as stated by a number of other persons who witnessed the occurrence; but of the blow itself, how, when, and from whom it was received, not the slightest impression had been made on his mind. Except the surface bruising on the back of the head, which lasted a few days only, no bad effects were experienced from the blow, and his mind and memory are unimpaired.

A similar result was observed, during the late war, in persons stunned by the explosion of shells. A gentleman now in this city, who was an officer in the Confederate Army, was fighting in the ranks, at the battle of Murfreesboro', in Tennessee. Just as he was in the act of taking aim with his rifle, a shell struck his weapon and exploded. He fell senseless, blackened with powder, and apparently dead. He had been struck on the head and other parts of the body with fragments of the shell, and was dangerously wounded; but after an unconsciousness of several hours, he was discovered to be alive, and was cared for and recovered. His mind and memory are as clear as ever, and he is now a successful lawyer in full practice. He assures me that no impression of the explosion of the shell was made on his mind. He saw no flash, heard no sound; he recollects distinctly aiming his rifle to fire; but after that, there is a perfect blank in his memory until his resuscitation.

These instances appear to indicate that the nerves of sensation may be paralyzed in less time than is required to make an impression on the mind which memory will retain. What time is required to make such an impression? The flash and noise of the explosion of a shell immediately in front of a man in battle would excite the nerves of sight and hearing as violently as it is possible to excite them; and in the last instance stated, the light of the flash certainly reached the eye before the fragment struck the head. What caused the delay in stamping an impression of it on the memory, and how long must the vital organs remain intact to enable the mind to receive an impression through the senses?

It seems to me that these questions suggest a field for scientific inquiry, in which important results may be reached.

Montgomery, Ala. D. S. TROY.

Crude Petroleum in Steam Boilers.

To the Editor of the Scientific American:

Mr. I. M. Allen, President of the Hartford Steam Boiler Inspection and Insurance Company, says in his report: "In some parts of the country, crude petroleum has been found to keep boilers free from scale without injury to the iron; while in the same districts and in the immediate vicinity, boilers not using purifiers would have a scale from ⅛ to ¾ inches thick." He continues: "We have a specimen of scale in this office nearly 1½ inches thick, that was removed from a boiler in the West by crude petroleum. I am aware that there is a great prejudice against using anything of the kind in steam boilers, but earth oils are very different from animal oils. They are very volatile; and in an experience of several years, where hundreds of boilers have been treated with them, we have found no injury to plates or tubes, and the boilers have been kept free from scale." Further on in the report, he again says: "Feed water heaters are of great service in removing sediment, if they are of proper construction. But an open heater, using exhaust steam, with no appliance for preventing grease and sediment from entering

the boiler, is not to be relied upon; and as I have already said, steam users should be careful, in selecting a heater, to get the best; we have experienced a vast amount of trouble with improperly constructed heaters. The subject of incrustation and scale is one that cannot be elaborately treated in a report like this," etc.

Now, what struck me as peculiarly significant in the above is the fact that the president of the above named company says that, during several years, they have known hundreds of boilers to be kept free from scale, etc., by the use of crude petroleum in the boilers, and that he should afterwards discourage the use of open heaters as being peculiarly fitted to let grease into the boilers. It would have been more consistent with his experience of the use of crude or rock oil, as a boiler cleaner, to recommend the use of open heaters, provided rock or crude oil is used as a lubricator; for it is only by the use of an open heater that crude or any other oil can be gotten into a boiler while it is in use; and a constant and unvarying supply must certainly be better than an occasional and perhaps not a sufficient one. My own experience, as a mechanic and user of engines and boilers, is that, where crude or rock oil is used as a lubricator for cylinders, there is no objection to the open heater; but on the contrary, it is beneficial to the boiler and a pretty sure preventive of scale or incrustation. I do not think, however, their use with animal oil is to be recommended; but with crude oil, properly prepared, there does not seem to be any objection at all, but, on the contrary, benefits.

In my own case I have used an oil prepared from petroleum, which is especially adapted for lubricating hot surfaces; and by its use, I have overcome the objection brought by Mr. Allen to the use of the open heater.

I hope that you will, as early as possible, clear away the confusion on this subject, and thus confer a great benefit on those whose business compels them to use steam boilers.

Detroit, Mich. ONE OF THEM.

A Sewing Machine Engine.

To the Editor of the Scientific American:

There is probably no field that presents more instances of simple and apparently perfect mechanical construction than that of steam enginery. I recently saw an extremely simple oscillating engine in one of the show windows of a sewing machine store. It consisted of scarcely more than a cylinder of about $2 \times 1\frac{1}{2}$ inches, clamped to one of the rear corners of an ordinary sewing machine table; the clamp serving also as a rest for the trunnions of the cylinder, the engine being connected by a belt to the upper pulley of the sewing machine. The oscillation of the cylinder caused the alternate admission and discharge of steam, the steam being supplied through a one quarter inch flexible tube. The boiler was about the size of an ordinary one gallon milk can, and could be placed in any convenient out-of-the-way place, in the room or out of it; the vertical tubes of the boiler were made of extremely thin brass, and braced within with a spiral wire.

I know nothing as to the success of this device; but it would be difficult, I think, to get up anything more simple for the purpose, in the line of steam engine manufacture.

Some cheap power, either steam, air, or something else for working the sewing machine for family use, is one of the great needs of the time; and inventors who have the subject in hand should bear in mind that, in order to succeed, their devices must be cheap, durable, and inexpensive to run. To ensure the first of these qualities, the device must be very simple; to ensure the second, it must receive the very best material and workmanship. F. G. W.

The Eucalyptus or Australian Blue Gum Tree.

To the Editor of the Scientific American:

I have just read an interesting article in the SCIENTIFIC AMERICAN of February 14, upon the Australian fever tree, or, as it is called here, the eucalyptus or Australian blue gum. In closing your article, you state that this tree, which is now attracting considerable attention to its medicinal and sanitary qualities, has been acclimated to the south of France, Algiers, Corsica, Cuba and Mexico, and suggest that it might be cultivated to advantage in the swamps of the Southern States. I thought it might not be uninteresting to you to know that this tree is already being extensively cultivated in California, where it was introduced over twelve years ago. Some of the trees that were set out in this city about that time are now 70 feet in hight and 20 inches in diameter. Probably 100,000 of these trees have been sold in this city and San Francisco this season; and not less than that number are already growing in and about this city, the tree being very popular on account of its quick growth and clean, lasting foliage, to say nothing of its sanitary qualities. I have raised from the seed and planted about 10,000 on a farm within two miles of Oakland during the past four years. The first were planted four years ago this spring; and when set out, were from 12 to 15 inches in hight. Some of these trees have already made a growth of 40 feet. The land is rolling foot hills, 300 feet above tide water; and the trees have passed through three unusually dry seasons and have had no attention except being plowed once each year and kept clear of weeds. Thus they seem to flourish equally as well as those planted in the low lands or marshes, better in fact than the latter. No tree here, excepting the Monterey cypress, indigenous to California, seems to stand the drought so well as the blue gum, which has made it a very popular ornamental tree. Upon my place I have some five or six varieties of the same tree, namely, the blue, red, white, iron bark and pepperetta. Of these, the blue gum is the quickest in growth and is the most extensively cultivated.

The seeds are first started in hot beds. After the plants are up an inch or two high, they are placed under slats to harden and prepare them for the hot sun when set out, which has to be carefully done, without removing the boll from the roots. The tree then makes a vigorous growth, frequently shooting up five or seven feet in the first year, the green stalk having the appearance of a rank weed. This appearance will continue for two years, when the tree not only begins to change the appearance of its body but also the shape of its leaves; the latter, which when young were very broad and blue, now begin to appear at the top of the tree, long, slim and of a very dark green, the tree thus carrying in appearance two distinctly marked leaves. I have sent you by express four different varieties of these leaves, which I hope will reach you in a state to explain more fully than I have done here.

The eucalyptus appears to stand a great deal of frost after a growth of two years. In fact our unusually cold weather here, this season, the ice being frequently frozen as thick as a dollar, does not seem to have affected the young trees in the least. The tree will undoubtedly flourish well in the Southern States; and after what is known of its sanitary qualities, it should be extensively cultivated. The seeds are very small, probably 5,000 to the ounce, and can be had of seedsmen in San Francisco.

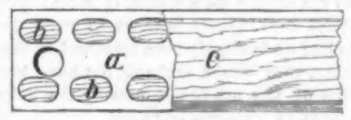
The eucalyptus is already being extensively planted in this State for lumber and fuel; for the latter purpose, it is superior to any timber we have here. As a shade tree, it is entirely free from insects. The leaves placed among clothing are a thorough protection from moths. J. G.

Oakland, Cal.

To Make a T Square.

To the Editor of the Scientific American:

Two years ago, a T square blade which possesses the advantages of both wood and steel was made; and though somewhat expensive, it is an excellent instrument.



In a piece of sheet steel, *a*, 36 inches long by $2\frac{1}{2}$ wide, and $\frac{3}{64}$ of an inch thick, holes *b*, $\frac{1}{8}$ by $\frac{1}{4}$, were punched as shown. These holes were filled by pieces of mahogany pressed in firmly with a vise, and then worked down even with the metal. Pieces of mahogany, *c*, the same size as the steel and $\frac{1}{8}$ thick, were then laid one on each side, and the whole glued together and clamped upon a planer table, where, after it was thoroughly dried, the edges were planed parallel without moving the blade. The wood covering was next reduced to $\frac{1}{32}$ of an inch in thickness, and the corners beveled.

New Britain, Conn. F. H. R.

Value of the Scientific American as an Advertising Medium.

To the Editor of the Scientific American:

I can fully endorse what a correspondent says on this head, in your issue of February 28. Ten years since, I made and sold a small article, which had its day and then passed, as I supposed, into oblivion. Last week, however, I received new orders for it. I am afraid now to advertise in your paper, lest, some quarter of a century hence, parties will demand service long after I am dead and forgotten.

EGBERT P. WATSON.

About Ourselves.

MESSRS. MUNN & CO:

Gentlemen: I take the earliest opportunity of returning you my most sincere thanks for the efficient and honorable manner in which you have conducted the business of obtaining for me a patent for my self car coupling. After employing, during the past five years, as many different agents and failing in each case, it was my good fortune to fall in with a gentleman who strongly advised me to go to you, assuring me that, if I did so and it were possible, a patent could be obtained through your agency. That he was not disappointed in his estimation of your ability, the receipt of my letters patent is sufficient proof; and I, therefore, cannot allow the opportunity to pass of making due acknowledgment of your straightforward and honorable course as patent agents, and I shall not fail to advise all my friends, seeking a like accommodation, to place their business unreservedly in your hands. As we receive the SCIENTIFIC AMERICAN here through the hands of news agents, I presume I shall see a notice of my invention among the notices of patents secured through your agency, which I find in the weekly issue of your valuable journal. THOS. R. LAND.

Grass Valley, Nevada county, Cal.

The Hartford Steam Boiler Inspection and Insurance Company.

The Hartford Steam Boiler Inspection and Insurance Company makes the following report of its inspections in the months of December, 1873:

The number of inspection visits made during this month was 1,156, and the number of boilers inspected, 2,318; of these, 771 received thorough internal inspection. The hydraulic test was applied in 132 cases. These were upright tubulars, or new boilers in the yards of the boiler makers. The whole number of defects discovered was 948—of which 262 were regarded as dangerous. These defects in detail were as follows:

Furnaces out of shape, 43—13 dangerous; fractures, 64—40 dangerous; burned plates, 54—24 dangerous; blistered plates, 174—34 dangerous; deposit of sediment, 138—15 dangerous; incrustation and scale, 120—19 dangerous; external corrosion, 76—17 dangerous; internal corrosion, 31—8 dangerous; internal grooving, 10—4 dangerous; water gages defective, 29—6 dangerous; blow-out defective, 28—11 dangerous; safety valves overloaded and defective, 19—8 dangerous; pressure gages defective, 137—25 dangerous, varying from −20 to +12. Boilers without gages, 66—5 dangerous; deficiency of water, 5—2 dangerous; braces and stays broken and dangerously loose, 67—26 dangerous; boilers condemned, 13. The comments which are made on these reports from month to month may appear to some readers a little stale. We know there is a striking similarity in them all; but when such facts as those above are enumerated, month after month, it shows that there is great need of frequent and careful examination of steam boilers. It must be born in mind that there are all kinds and types of boilers in use in the country, and that the average ability of attendants is very low. Defects which point directly to disaster are met with almost daily, and we believe many explosions of boilers have been prevented by the thorough examination which has discovered such defects as those in the above report. A cursory examination or a simple test will do little towards bringing such defects to light. The work must be thorough, and time enough must be taken. No specific rule can be laid down for making these examinations. Each case requires treatment in accordance with the circumstances connected with it: these are the type of boiler, pressure carried, character of bracing, quality of water, efficiency of attendant, etc., all of which have much to do with the question of preventing boiler explosions. Experiments on obsolete or special types of boilers will do little towards preventing the explosion of boilers in use, because the conditions under which boilers are used in manufactories are very different from those under which experimental boilers are used. Valuable information can be obtained on certain points by well directed experiments. Tests of safety valves are an important matter, and one that should receive special attention. It may, however, be a question whether the best way of making such tests would not be to subject them to actual use on boilers that were doing regular duty, day after day, for six months or a year. We believe in tests that are practical, and our experience goes to show that, especially in a question of such vital importance as that which seeks for its solution the prevention of boiler explosions, too great care and too much time cannot be taken. A great many worthless boiler appliances have been palmed off upon steam users, the only proof of their efficiency being that they had worked well under some experimental test. But when subjected to the conditions of constant use, they have proved utterly worthless.

During the months of November, December, and January, there were 37 boiler explosions in this country; 14 of these were in saw mills and planing mills—7 were railroad locomotives. In one instance, a boiler exploded while being tested by steam. We have never known of but one other instance of testing boilers by steam. This was done by the boiler maker himself, and he was killed, with two others who were assisting him. We think in both cases there was lamentable ignorance. The parties had doubtless read or heard of testing boilers by the expansion of water by heat. It will be readily seen that testing boilers by steam pressure is about as suicidal as to be suspended by a rope around one's neck to test his ability to withstand hanging.

Improved Compound Marine Engines.

The principle of the "compound" steam engine, from which so much good and economical work has of late years been obtained, is that it has both a high and a low pressure cylinder or cylinders, and that the steam which has done duty in the former is made to do duty also in the latter, before it is suffered to escape. The compound engine was first patented by Arthur Woolf, in the year 1804; and he placed the two cylinders in a vertical line, one above the other, and worked them by a single crank. Since that time a great many experiments have been made in relation to the subject, and also most every conceivable combination of cranks and cylinders has been tried; but the accepted type at present is the two cylinder engine, with the cylinders either vertical or side by side. Messrs. Lamport and Holt employ the former construction, with a single crank, and thus return almost precisely to the principles laid down by Woolf, seventy years ago. It now appears that, if his invention had been earlier appreciated at its true value, many millions of tuns of fuel and many hundreds of thousands of pounds sterling would have been saved. The present price of fuel is so high, and its unnecessary consumption is so much to be condemned, on account of the influence which the coal supply exerts over the cost of iron and of many other commodities, that shipowners will often find it necessary to make quickness of passage subordinate to other considerations, and will be forced to inquire how they may safely convey the largest cargoes from port to port at the best paying speed, and with the least expenditure of coal and stores, rather than how they may attain the highest speed without reference to its cost.—*Iron.*

Mr. A. Augustus Adee, United States *Chargé d'Affaires* in Spain, is a native of New York. He speaks and writes the French, Spanish, and German languages, and has superior qualifications for the position he holds. He has been in the diplomatic service for five years, and was for three years Secretary of Legation at Madrid. We have had occasion to require Mr. Adee's services a number of times since his residence in Spain, and we can personally testify to his superior ability in the administration of the office he holds under our government. But few of our representatives abroad fulfil their mission as acceptably to their countrymen as Mr. Adee.

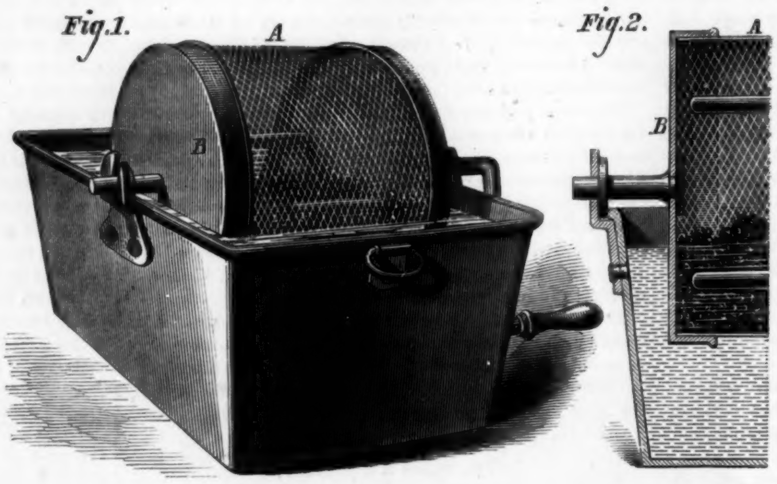
OAKLEY'S CURRANT WASHER.

Dried currants, as purchased from grocers, are frequently not over clean, so that it is usually necessary to wash them before preparing them with articles of food. In order to provide a simple and efficient means to enable the housekeeper to perform this operation, the device represented in perspective and section in the annexed engravings has recently been invented.

The principal vessel is an ordinary bake pan of any desired size, in proportion to the desired capacity of the machine. To its edges are affixed suitable bearings for projections from the central portions of the ends of a cylinder, A, the sides of which are formed of perforated sheet metal. The latter is rigidly secured in the end which carries the crank, but the solid portion of the other extremity forms a cap, B, as shown in the section Fig. 2, which is readily removable to give access to the interior of the cylinder. Two rods are secured to the inner side of the crank end and extend into the cylinder, in order to secure the agitation of its contents.

The large lumps of currants which have caked together being first broken up, the receptacle is filled and the cap, B, tightly fitted in place. The projections are then dropped in the bearings and the trough filled with water to within about half an inch of its upper edge. If the cylinder is then rotated slowly by means of the crank, the inventor states, within two minutes the currants will be entirely freed from grit and a large proportion of the stalks. If they be very dirty, the water may be advantageously changed, and the process repeated. The fruit thus prepared can be dried or used as required, without the usual rubbing in a cloth.

Patented January 13, 1874. For the purchase of rights or of the entire patent, apply to F. Oakley, 96 Bond Street, Toronto, Canada.



OAKLEY'S CURRANT WASHER.

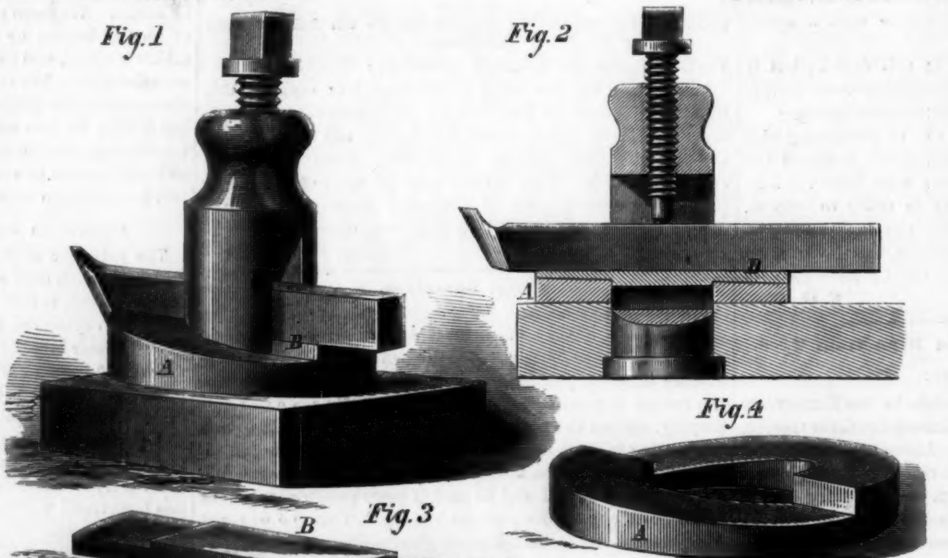
A NEW TOOL HOLDER.

All machinists are aware of the trouble in getting a lathe tool so held in the tool post that it can be quickly and conveniently elevated or depressed as the work may require, and still be held perfectly solid upon the rest. Many devices to effect this result have been suggested; but in those in which cheapness is the principal recommendation, the difficulty appears to arise from a want of solidity under the tool. Mr. Lewis Reder has patented, through the Scientific American Patent Agency, a simple and effective tool holder that seems to meet this want.

From the annexed engravings it will be clear to any mechanic that one incline of the washer, A, Fig. 4, is higher than the other, the pitch being just the same; and, second, that the shoe is thicker (see Fig. 3, and B in Figs. 1 and 2) at one end than the other, both extremities of it being beveled to suit the inclines of the washer. This simple little article, with momentary changes, produces four positions for the lathe tool, holding it perfectly firm in each, namely: First, by placing the thin end of the shoe and high part of the washer together, the tool is held in a level position; second, by turning the washer so that the thick end of the shoe and high part of the washer are together, the point of the tool is thrown below the level; third, by now turning the tool post and washer half round, the point of the tool is thrown above the level; and, fourth, by turning the washer around the tool post, the tool is adjusted to any hight under any of the three conditions named above.

The advantages claimed for this simple improvement are its comprehensiveness, solidity, durability, and extreme cheapness.

Mr. Reder has arranged for its introduction to the trade of the United States with E. and A. Betts, machinists' tool builders, of Wilmington, Del., who have prepared themselves with suitable apparatus to manufacture the invention of cast steel, at low prices.



REDER'S IMPROVED TOOL HOLDER.

Use of Steel for Boilers.

Mr. R. L. Haswell, of Vienna, spoke recently on this subject before the Society of Austrian Engineers. He remarked that the accidents which had occurred on railways using locomotive boilers of steel has thus far been only ascribed to the material; yet this was due, on the one hand, to the preparatory working of the plates, and on the other to the small thickness, as well as to the insufficient mode of assorting them before they were used. The State Railway thus far had used about 50,000 cwt. steel plates, among which only 200 cwt. were thrown aside during the manufacture of the boilers.

Mr. Haswell only knows of five instances where the boilers got cracks, four of which occurred in the fire box plate and one in the cylindrical part. Mr. Haswell ascribes their faulty condition to the fact that they were rolled when too warm. This shows that, even by purchasing steel plates from most renowned establishments, and of the best quality, one cannot depend on their superiority for the purpose in question without assorting them with the utmost care, because it can readily occur that in heating the plates one or more get spoiled. Hence, in the establishment of the State Railway, all plates are subjected to tests for their tensile strength before they are used. That these tests are perfectly reliable is shown by the fact that, of 350 boilers consisting of steel plate, only a single one was found torn thus far, and this in the cylindrical part. The box plates not having been tested, it is readily explained that four boilers were injured in those parts. But, although these plates had undoubtedly been impaired in their strength by overheating, they would probably not have been torn if the construction of the machines, namely the boiler supports, did not involve an immense strength.

In order to obtain steel boilers answering all requirements, only correspondingly thick plates and plates of the best material, without any addition (for otherwise the steel is not homogeneous), ought to be used; they ought to be scrupulously assorted according to the texture and tensile strength. After boring or punching they should be carefully annealed; the riveting must be formed with pedantic care, and the bending done with wooden hammers. That steel plates manufactured in Austria are of excellent quality is proven by the manner in which boilers are there constructed; the box front plate, dome cover, and the sides of the tubes are only furnished with an edge or border, while in England they are compelled to use angle iron for these connections.

Steel plates are preferable to iron plates, owing to the fact that they possess the same degree of elasticity in all directions —from 12 to 15 per cent: in iron plates it is in the direction of the fibers, and, according to Mr. Kirkaldy, about 15 per cent, but in a cross direction only 5 per cent. If one proceeds in the manner indicated, says Mr. Haswell, steel plates may be used with perfect safety. The boiler manufacturer has the advantage that he finds fewer plates to throw aside, and the railways, on the other hand, will have more carefully constructed, stronger, and, in the end, cheaper boilers.—*Industrie Zeitung.*

THE Dudley Mining Institute, England, offer a prize of $100 for the best model of a hand coal-cutting machine submitted to the Council next June. Mr. T. Parton recently stated that the ordinary loss of coal is 40 per cent, owing to the imperfect methods of working it. Where the best arrangements are in force, the loss does not exceed 10 per cent.

A Railroad Signal Office—An Hour in the Grand Central Depot at New York.

A correspondent of the Troy *Times* gives the following account of the mode of dispatching and receiving trains at the Grand Central Depot in this city:

The signal office is a little room at the northern entrance of the depot, about thirty feet above the pavement. It is reached by a narrow passage way from the west side, and when you get into it you see a sight which made Jones go into an unmistakable surprise. Looking down the depot there was a space of more than 600 feet length by 200 feet breadth, covered with an iron roof and lighted from the top. Trains of cars were coming and going incessantly, but no confusion was perceptible, and everything, as my friend said, "went on like clock work." There are two operators in service here, relieving each other during a tour of duty, which extends from 5 A. M. to 11 at night, their motions being regulated by a large and costly clock. The gentleman in charge received us very politely; but before we had hardly thanked him, we heard the sharp and rapid ring of a bell overhead. It was marked "Ninety-sixth to Seventy-fifth street." "You see," said the operator, "there is a train coming in, and it wants to know if we are ready for it." "But how does it ring that bell?" said Jones. "By electricity," was the reply. "This is Hall's patent, which works like a charm." In a few minutes another bell rang. It was marked "Sixty-first to Fifty-sixth street." "The train now reports itself again," said the operator, "and this renews notice either to prepare for it or to signal it to stop." He touched a telegraphic machine, and then said, "this throws up the signal to come in," and, sure enough, in a few minutes the train arrived. One hundred and forty trains arrive and depart in a day, including the Central and Hudson, the Harlem, and the New Haven Roads, and hence the signal service is one of incessant activity. The operator then informed us that each road has four starting bells of different keys, all of which were rung by him by means of electricity. Three started passenger trains, and one ordered out the cars as soon as emptied. "You see," said he, "this train which has just come in. The passengers are gone, and I want to know if the baggage is taken out." He touched a stop and rang a bell (as he said) 600 feet distant. In a moment a bell overhead struck twice. "Baggage is out," he said, "otherwise he would have struck once, and I would have waited. I must order the train out. Do you see that locomotive just ahead? Well, now, see it move." He touched a stop and I saw the letter Z displayed at a window in a side building. "He hears a bell ring, also," said the operator. The engine backed down and hitched to the empty train and the Z disappeared. "I shall now send him out," said the operator, as he touched another stop, and the empty train at once moved forward and left the station. The letters X Y Z (I may add parenthetically) designate the locomotives of the Harlem, Hudson River, and New Haven Roads, and are the signals to back down and connect with trains.

"I am now about to send out a passenger train," continued the operator; "a half hour ago I struck twice to open the doors and let the passengers pass from the sitting room to the cars. Now I shall soon close that very door, but first I must stop checking baggage." A small knob was touched by his finger. "Now," said he, "the next trunk that comes must wait for another train. There (another touch with the finger), the baggage car is hauled out and switched on the right track. Five minutes more and she is off. Here goes the 'close the door bell' at a touch; no one passes in after this. Now I say 'all aboard,'" a touch, and we hear the distant voice of the conductor echoing through the vaulted roof. "Now it moves," another touch, and the rumbling movement was immediately perceptible, and in a few moments the train left the station. As the cars go up the road, they signal their progress by ringing bells in the same office until they have got through the city streets, and thus give assurance of a clear track for all that may follow. The station will contain twelve trains of thirteen cars each; and by means of this wonderful system, they are all managed with dispatch and safety.

FROG CULTURE.—Seth Green, the great fish culturist and State Commissioner for stocking streams, now proposes frog culture for food. He says: "We have many stagnant pools about the country, that are useless in their present state; and believing that there is nothing made in vain, I do not know of any other use for them than to make them into frog ponds. I also believe it would make the man wealthy who could raise a million frogs and get them to market."

ONE hundred cubic inches of air weigh thirty-one grains

A NEW WATER METER.

Mr. Charles Deacon, C. E., engineer to the borough of Liverpool, has recently brought into use a water meter which he applies to mains for the purpose of detecting waste. The invention, says *The Engineer*, to which we are indebted for the engraving, consists of a vertical tube lined with brass and equal in diameter at the upper end—where it is connected with the inlet from the main—to the diameter of that main, but larger at its lower end. In the tube is a horizontal disk of the same diameter as the main, with a vertical spindle on the center of its upper face, from the end of which the disk is hung by a fine wire passing out at the top of the tube through a brass gland. The wire is connected above with a counterbalance weight, which, when the water is at rest, retains the disk at the top of the tube, which it completely fills. If water is caused to flow through the instrument, the disk will find somewhere in the tube a position which it will retain until the velocity of the water changes. The lower end of the conical tube being about double the area of the main, no obstruction to the flow can take place, while the motion for any given increment of velocity near the top, or place of minimum flow, can be made equal to, or even greater than, that due to an increment at the bottom or point of maximum flow, so that its sensitiveness is not diminished at low velocities—a feature which is unattainable in any meters constructed on the turbine or analogous principles.

In order to insure the absence of any friction it was found desirable to abandon the use of a stuffing box, and to substitute a single brass gland, the hole in which fits the wire accurately, but not tightly. This wire, being an alloy of iridium and platinum, maintains its condition for any length of time, and the small quantity of water which oozes past it is allowed to drain away. The absolute accuracy and freedom with which the meter acts has been proved by the strictest tests. The vertical motions of the wire are registered by a pencil, connected with it, on a drum revolving once in twenty-four hours, the paper on which can easily be removed at any time and replaced by a sheet with horizontal lines, each of which corresponds with the hight at which the pencil stands when the number of gallons per hour marked upon the line is equal to the quantity passing through the meter. The essential peculiarity then of the waste water meter is that it registers on paper the exact quantity of water moving at every instant, and the exact time and rate at which that quantity changes. At twelve on the first fine night, a waste water inspector sounds each stopcock on the house supply pipes. If the inmates have retired, and a flow of water is heard, the stopcock is closed, its number and the time being accurately noted. At the same instant the meter registers the reduction in the flow of water, and the time at which it takes place. It is sometimes found desirable to arouse the inmates and enter the house, in order to obtain the necessary evidence of waste, especially when the running of water from taps is heard. In other cases the house is visited by the inspector early on the following morning; and if, while he is within, another inspector outside turns on the stopcock, there is generally no difficulty in detecting the source of waste at once. If, however, the waste is not superficial, sounding with the teeth at the taps and other fittings will generally discover a leak in the buried pipes. Each source of internal waste having been discovered by these means, the greatest care must be exercised by the inspectors to insure its remedy in the best possible manner.

A New Method of Determining the Sun's Distance.

The method consists in determining the parallax of one of the exterior planets when in opposition, not by micrometrical measurements of its distance from neighboring stars, but by noting the exact moment at which it may occult a given star and the duration of the occultation (provided such a phenomenon takes place). Theoretically, this is perhaps the most accurate of all methods, but there seems to exist, at first sight, an insuperable objection to its practicability; namely, the apparent impossibility of noting the exact instant of the disappearance and reappearance of the star. If we can get over this difficulty, nothing will stand in the way of a successful application of this method to determine the sun's distance. And here the spectroscope comes to our aid, and affords us the means of conquering this difficulty most completely.

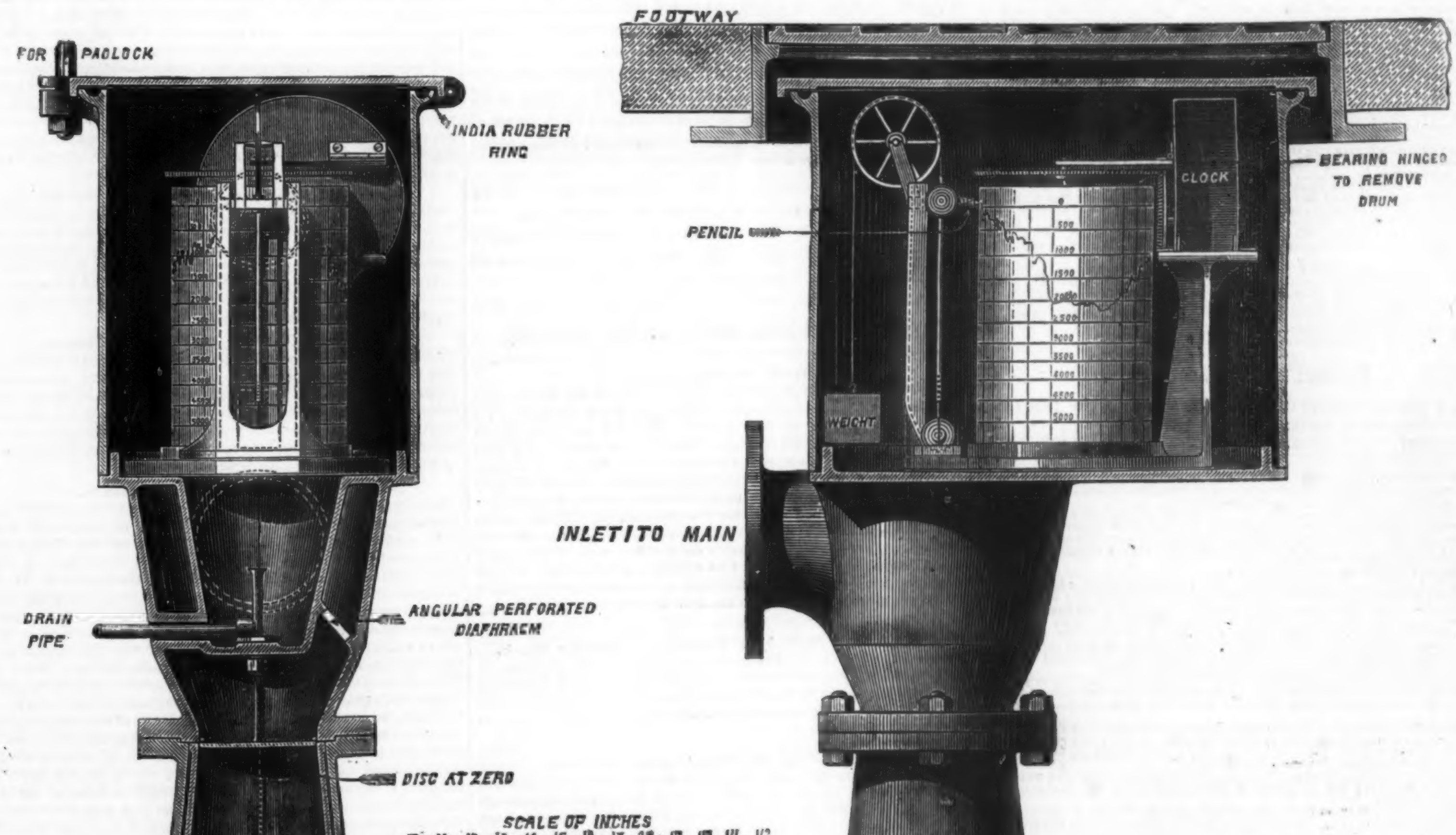
Suppose, just previous to the expected disappearance of the star behind the body of the planet, the spectrum of the two be brought into the field (the star being at that time of course very close to the edge of the planet's disk). We shall evidently have the spectrum of the star superposed on that of the planet, the characteristic stellar lines appearing as well as the planetary ones. This double spectrum will continue visible in the field of view so long as the star's light reaches the observer, but the instant its light is cut off by the advancing disk of the planet, at that instant will the stellar spectrum vanish. However slow the apparent motion of the planet, and however dubious the time of the star's disappearance, as determined by telescopic observation, it will be seen that the result obtainable by this method of observation must be most rigorously exact.

The only doubt as to the value appears to be the infrequency of the phenomenon. This, of course, depends entirely on the minimum brightness of the star compared to the planet, necessary to bring out its spectrum at the same time as that of the planet with the required distinctness. On the whole, Saturn would seem to be the planet most favorably situated for the occurrence of this phenomenon, as he has a considerable apparent diameter, while his being much less bright than Jupiter or Mars in opposition would allow of the use of much smaller stars than these two planets—his very slow motion also being a considerable advantage. By knowing previously, approximately, the portion of the planetary disk which will first occult the star, it would be easy to shut out a great portion of the light of the planet, and observe the spectrum only of that portion of the disk behind which the star would disappear. By an arrangement of this nature, I believe that stars down to the fifth, or even the sixth, magnitudes might be very well used for this purpose with either of the three above mentioned planets; and occultations of stars of these magnitudes cannot be very infrequent.—*George F. Hardy, in the English Mechanic.*

New Steam Auxiliary.

A new invention by Mr. J. Berger Spence, of London, consists in passing steam at ordinary atmospheric pressure into a solution of caustic soda, which is thereby raised to its own boiling point. It is proposed to use the heat thus developed to generate steam, the waste steam from an engine boiler being employed in the first instance to heat the caustic soda. Mr. Spence showed that the effect was absolutely produced by raising a solution of caustic soda to a heat considerably over 212° by means of a jet of steam, but he stated that he had not yet worked out practical details as to the employment of the idea, though he exhibited a sketch of an arrangement of boilers which he considered might render it available.

THE combustion of one pound of coal in one minute is productive of a force equal to the work of three hundred horses during the same time.



DEACON'S WASTE WATER METER.

NEW BOOKS AND PUBLICATIONS.

ANIMAL PHYSIOLOGY; the Structure and Functions of the Human Body. By John Cleland, M.D., F.R.S. With 158 Engravings. Price $1.50. New York: G. P. Putnam's Sons, corner Fourth avenue & 23d street.

An elementary work on the science, designed as an introduction to more extended treatises. It is also well adapted to interest the general reader in that most fascinating of studies—one's self—and is sufficiently free from technical verbiage to render the perusal of its pages pleasant while, of course, instructive. We note no especial difference in the plan of the book from the similar work prepared for collegiate uses by Professor Huxley, and it is necessarily a compilation from various sources. The illustrations are both excellent and numerous, and a valuable glossary occupies the concluding pages. The volume is a reprint from the English edition, and forms a part of Putnam's Advanced Science Series.

HYDRAULICS OF GREAT RIVERS: The Paraná, the Uruguay, and the La Plata Estuary. By J. J. Révy, C.E. New York: E. & F. N. Spon, 446 Broome street.

The government of the Argentine Confederation, three years since, authorized an investigation into the question of the watershed of their territory, extending from the Rio Vermejo to the Rio Negro, and from the South Atlantic to the Andes. This work was most thoroughly done by M. Révy, of London, England, and the result is before us in an exceedingly handsome volume, illustrated with maps, plans, and sections. The book will be valuable to engineers generally, and especially to those engaged in similar work, as the author's analysis of his results treats the subject of fluvial drainage in the broadest manner; and he gives due commendation to the Argentine Republic for contributing this volume to our libraries of physical geography.

PATENT OFFICE DECISIONS.

SPLINT MACHINE.—RUSSELL AND SCOW.—INTERFERENCE.

[Appeal from the Board of Examiners in Chief in the matter of the interference between the application of Samuel I. Russell, and the patent of Anton F. Snow, granted May 23, 1871, for improvement in machines for cutting splints.—Decided February 17, 1874.]

The case of Fawcett vs. Graham, C. D., 1869, p. 118, referred to and approved.

It is a well established principle that an inventor has the right to employ the mechanical skill of others to carry out his ideas without forfeiting his right to the invention.

In an interference, one who is shown not to have been an original inventor can derive no advantage from having obtained a patent.

Abandonment of an invention is not favored; it can only be established by positive proof, and not by mere presumption or inference.

THACHER, *Acting Commissioner:*

This case, as developed by the evidence, presents for determination the question of originality rather than priority of invention.

The Examiner of Interferences and the majority of the Examiners-in-Chief have found in favor of the applicant Russell. The rule of practice in such cases has been stated by the Commissioner in Fawcett vs. Graham. (C. D., 1869, p. 118.)

In this appeal it is not shown that the tribunal below erred in the finding of facts in the case; but the most that can be claimed is that the Board erred in deciding the weight of testimony to be with Russell. This judgment of two tribunals ought not to be set aside except upon the clearest showing that it is contrary to evidence. This, in my opinion, has not been done; on the contrary, after carefully reading the testimony and both parties, I have no hesitation in concurring in the decision of the Board and Examiner that, although the testimony is conflicting, the weight of evidence is with the applicant.

What Mr. Scow understands by invention may be gathered from a portion of his "answer 4," where, after stating that Russell suggested putting on an eccentric, he says he invented it as described in his patent. It appears that he believes the person who carries out the ideas and suggestions of another to be a true and original inventor. This may furnish an explanation of his claim to the invention patented. Russell was the employer; Scow was the foreman of one of his shops. Now, it is shown that Russell was in the habit of giving general instructions to his foreman, who proceeded to embody them in suitable form, and in doing so gave the necessary instructions to the workmen under him. From my reading of the testimony, I am tolerably well satisfied that this is the way in which Scow got up the new splint machine. But it is a well established principle that an inventor has the right to employ the mechanical skill of others to carry out his ideas without forfeiting his right to the invention. This, I believe, is what Russell did.

Considerable stress is laid upon the circumstance that Russell delayed to file his application until some time after the grant of a patent to Scow; and the assertion is made that this delay occurred with full knowledge of Scow's application and patent. I am unable, however, to find a particle of evidence that Russell had knowledge, either of the application by Scow or of the issue of a patent to him. There is, therefore, no presumption of acquiescence in Scow's claim to the invention, for he had never made it in the presence of Russell, who, so far as shown, had no information of the claim set up in the Patent Office; and if Scow is not an original inventor he is not to receive any advantage from having hurried to the Office and obtained a patent.

It has also been urged that the evidence shows more than two years' public use of the machine by Russell prior to his application for a patent; but this is by inference only. Now, abandonment by public use or otherwise is not looked upon with favor. It can only be established by positive proof. Mere presumption or inference will not answer; and this suggestion, therefore, may be summarily dismissed.

The decision of the Examiners-in-Chief is affirmed.

DECISIONS OF THE COURTS.

United States Circuit Court—District of New Jersey.

CHARLES GUIDET vs. SAMUEL BARBER.—PATENT STONE PAVEMENT.

[In equity.—Before Nixon, Judge.—Decided December 30, 1873.]

NIXON, *District Judge:*

This bill is filed by the complainant for an injunction and an account for the infringement of reissued letters patent granted to complainant August 23, 1870, for "Improvement in Stone Pavement."

The single claim in the reissue is for "a pavement composed of stone blocks made in the form of parallelopipeds, having their narrow ends or edges cut smooth and their broad sides purposely cut rugged or uneven, when the blocks are arranged with their rugged surfaces transversely to the street, substantially as described."

The answer of the defendant alleges—

1. That the reissue to the complainant was fraudulent and void, because the surrender was not made for the purpose of correcting any errors or imperfections in the description or specification of the original patent, but to cover and claim as complainant's invention many things in the art known and used long prior to his alleged invention or discovery, and because the said reissued letters patent covered and included many things of which the complainant was not the first and original inventor, and which were not described or claimed in the original letters patent.

As it is the duty of the Commissioner of Patents to see that the reissue does not cover more than the original patent, the presumption of law always is that the reissue is for the same invention until the contrary is shown.

No attempt is made by the defendant, upon whom the burden rests to prove the allegation of fraud in the reissue, and the court can hardly be expected to presume it. (Sec. 53, act of July 8, 1870, Judson vs. Dobson, 2 Abb. U. S. Rep., 404 Curt. on Pat., Sec. 281.)

2. The defendant also alleges prior use, and abandonment to the public by the complainant; but he gives no notice and offers no evidence to sustain the charges.

The only matter put in issue by the answer and the proof is the question of infringement. The defendant denies the allegations of the bill in this respect, and the burden is upon the complainant to show it.

The laying of a stone pavement on South Broad street, facing Lincoln Park, in the city of Newerk, is admitted by the defendant, and the expert witness, J. Boyd Eliot, is called to testify in reference to its construction.

He states that he has made an examination of said pavement; that he understands the principle of its construction, and that it corresponds substantially with the invention described in the complainant's reissued letters patent:

1. Because it is composed of blocks of stone made in the form shown and described in the said patent, consisting of parallelopipeds or solid figures, whose sides are parallelograms; said blocks being provided with ends or edges formed sufficiently smooth, that when they are abutted together in position to form a pavement, the joints or seams between the said blocks are closed, or substantially so, in a longitudinal direction, or parallel with the sides of the street, or in the direction of the line of travel along the street, so that the wheels of the vehicles passing over it will meet with a comparatively smooth surface, or be prevented from sinking into crevices or openings between said blocks.

2. Because said blocks are so selected and laid with their broad sides abutting against each other as to produce open joints in a direction transversely to the street, in such a manner that a firm foothold is provided for the draft animal traveling along the street, substantially as described in the said patent. He expresses the opinion that the combination of these blocks of stone to form a pavement is of such a character as to perform the functions set forth in the complainant's reissued patent, and the advantages to be gained in the formation of such a pavement, recited in said patent, exists to a substantial degree in the pavement constructed and laid by the defendant.

This testimony stands without material contradiction, and there must be a decree against the defendant, unless it should appear, upon further examination, that the invention of the complainant is not in fact a patentable subject.

The counsel for the defendant upon the argument took the ground that there was nothing patentable in the complainant's alleged invention.

It was objected in reply that, as no such defence was set up in the answer, it was then too late to urge it.

Whether the objection of the complainant is valid and sufficient depends upon what the counsel of the defendant meant by affirming that the invention was not patentable. If he meant that it was not on the ground of a want of novelty the objection was well taken, for such a defence falls under the 61st section of the patent act, and should be specified.

But if he meant that the invention was not a patentable subject—that is, did not come within the description of "any new and useful art, machine, manufacture, or composition of matter, or any new and useful improvement thereof not known or used before the application" for the patent, as required by the 24th section,—such a defence is authorized by the general pleadings, because the bill of complaint necessarily imports that the patentee has invented a patentable subject.

Assuming, therefore, that he meant the latter, the remaining question is whether the improvement claimed by the complainant is an improvement in "any new and useful art."

The patentee, in the specification of his letters patent, describes his invention as relating to a pavement composed of stone blocks, which are made in the form of parallelopipeds, and the surfaces of which are so prepared that the blocks, when placed together, will form close joints in the direction parallel with the sides of the streets or in a longitudinal direction, while the joints running transversely to the street remain open at the top, and thereby a pavement is obtained which offers a good foothold for the draft animals, and at the same time a smooth surface for the wheels passing over the same.

The edges of the blocks adjacent to the transverse open joints are to be chamfered off so as to insure a good foothold for the draft animals.

To exhibit its superiority over other forms of stone pavement, he further states that if a street is paved with truncated pyramids, as used in the Russ or Belgian pavement, close joints are formed at the surface of the pavement, both in a longitudinal and transverse direction, and said surface offers no foothold to the draft animals passing over the same; but by placing a series of blocks together, as exhibited in Fig. 2 of this reissue, close joints are formed in a longitudinal direction, and open joints in a transverse direction, and a stone pavement is obtained which offers a firm foothold to the draft animals, while it presents a comparatively smooth surface to the wheels of vehicles passing over it, and at the same time each block is firmly retained in position by the adjoining blocks without requiring any intermediate layers of stone or other material.

Such an improvement in the mode of constructing a stone pavement is a patentable invention, and must be held to be new in the absence of proof to the contrary from the defendant, and it is doubtless useful in the sense in which that term is used in the act, to what degree or extent is wholly unimportant, as it is not a question in the case.

Let there be a decree for the complainant for an injunction and an account.

Edmonds & Field and *George Harding*, for complainants.
George Foske, for defendants.

Inventions Patented in England by Americans.

[Compiled from the Commissioners of Patents' Journal.]

From February 2 to February 7, 1874, inclusive.

GUM EXTRACTION.—D. D. Cattanach, Providence, R. I.
HOEING, ETC.—R. McKinley, Hyde Park, N. Y.
IRON SHEARS.—W. X. Stevens, East Brookfield, Mass.
LIQUID METER.—F. W. Brooks, New York city.
METAL TUBE.—E. P. Wilbur, Bethlehem, Pa.
MOLDINGS.—J. Gochwind, Union, N. J., *et al.*
PIPE TONGS AND CUTTER.—F. T. Ferguson, Boston, Mass.
ROCK DRILLING.—W. W. Dunn (San Francisco, Cal.), London, England.
SEWING MACHINE—W. G. Beckwith, Newark, N. J.
SPINDLE BOLSTER, ETC.—C. F. Wilson *et al.*, Brooklyn, N. Y.
STEAM BOILER, ETC.—B. T. Babbitt, New York city.
STEEL FROG.—J. Patterson, Hornellsville, N. Y.
STOVE, ETC.—J. E. Sherman, Bucksport, Me.
WELDING COPPER.—W. G. Rehbein *et al.*, Baltimore, Md.

IMPORTANCE OF ADVERTISING.

The value of advertising is so well understood by old established business firms that a hint to them is unnecessary; but to persons establishing a new business, or having for sale a new article, or wishing to sell a patent, or find a manufacturer to work it: upon such a class, we would impress the importance of advertising. The next thing to be considered is the medium through which to do it.

In this matter, discretion is to be used at first; but experience will soon determine that papers or magazines having the largest circulation, among the class of persons most likely to be interested in the article for sale, will be the cheapest, and bring the quickest returns. To the manufacturer of all kinds of machinery, and to the vendors of any new article in the mechanical line, we believe there is no other source from which the advertiser can get as speedy returns as through the advertising columns of the SCIENTIFIC AMERICAN.

We do not make these suggestions merely to increase our advertising patronage, but to direct persons how to increase their own business.

The SCIENTIFIC AMERICAN has a circulation of more than 42,000 copies per week, which is probably greater than the combined circulation of all the other papers of its kind published in the world.

Recent American and Foreign Patents.

Improved Washing Machine.

Theophilus C. Eberhardt, Hochheim, Tex.—The box of the machine and rubbing boards are made semicircular in form. The faces of the latter are corrugated and perforated. They are supported and oscillated by the square shafts, which pass out through square holes of sockets, and have handles. The outer surface of the sockets is made cylindrical in form. The rubbing boards are forced forward by bent springs secured to the inner ends of the sockets, which slide upon the boards, when the same are drawn outward or apart. By suitable construction, the rubbing boards, shafts, sockets, and springs all move together, so as to always retain their proper relative positions. To the outer ends of the sockets are rigidly attached levers. These are pivoted to connecting rods, which connect with cranks formed upon a shaft. The shaft carries on its ends fly wheels, which may be arranged to rest upon the floor for convenience in moving the machine.

Device to be Attached to Fences for Turning Stock.

Jacob Haish, De Kalb, Ill.—This invention relates to modes of effectually turning stock with hoop band or other light railed fences, and consists in peculiarly formed barbs for deterring the animals from rubbing against the fence, or otherwise bringing to bear their weight, so as to break down, injure, or impair the same.

Improved Chest for Tea, Coffee, Rice, etc.

George Lillibridge, Little Cooley, Pa.—A vertical slide is arranged to regulate the size of the opening between the chest proper and a trough applied exteriorly, and thereby control the exit of the contents of the chest into the trough, from which they are removed by a scoop or other convenient device. The trough has a lid or cover as well as the chest, and thus the tea or other substance is kept from deterioration by the action of the atmosphere.

Improved Vault or Safe Door Fastening.

John B. Cornell, 139 Center Sreet, New York city.—This invention consists of auxiliary bolts connecting the locking bolt frame to the door, so that, when the primary bolts which hold the frame and door in intimate contact have been broken by an explosion, the auxiliary bolts, first allowing the door to be opened far enough to give vent to the force of the explosives, then arrest the further movement, and hold the door so nearly closed that access to the safe cannot be gained without cutting or breaking the door or bolts with tools. A second plan proposed consists of slots from the locking bolt holes in the frame extending obliquely upward or downward toward the inside of the frame a certain distance; these slots are so made that, while they will secure the locking bolts with ample security against the efforts of the burglars to pry and wrench the door off, yet the tremendous force of an explosive inside of the safe will force the frame along the bolts to the ends of the slots, and thus afford the necessary vent to dissipate the force of the explosion and still hold the door so as to demand too much labor for gaining access to be performed with safety after the noise.

Attachment to Self Raking Reapers for Carrying Binders.

Allen Elijah, Clarence, Iowa.—This invention relates to the stands employed upon that class of reapers wherein the grain is bound up into bundles before it is dropped, and the novel means for accommodating the binders. These means consist in a frame with a rear projection, a non-revolving shaft having end stirrups, and a stand connected with a stirrup by a chain at one front corner, and at the other with the projection of the frame.

Improved Stud and Button Fastening.

Philip H. Long, Newark, N. J.—This invention relates to the construction of stud and button fastenings for shirt bosoms, collars, wristbands, etc., and consists in a stud or button and base, so constructed that the two are securely fastened together by turning the stud or button as part of a revolution, and unfastened by a reverse movement.

Improved Fire and Water Proof Roof.

Tobias New, New York city.—The object of this invention is to provide means for protecting buildings (having interior wooden timbers) from fire as well as from water; and consists of a roof made of a stratum of fireproof material laid on felt or planking to about two inches in thickness. A piece of timber is bedded in the fireproof substance, and has its upper side flush with the surface thereof. On this is placed a water-repellent covering and over this an ordinary gravel, slate, tin, or other roof.

Improved Toy Gun.

John Alexander, New York city, and Hiram W. Gordon, Lynn, Mass.—This invention consists of a toy gun, in which a rod or pusher is thrown forward in the barrel by a spring, for expelling marbles and the like. The barrel has a funnel-shaped muzzle, in which marbles, peas, or other round bodies of different sizes can be held, by friction, in front of the pusher to be expelled, the said marbles and other objects being gently pressed in to secure them.

Improved Wind Mill.

William C. Nelson, Kentland, Ind.—The wheel is made in two sections, each having a separate portion of the hub, which is hinged to a middle portion which comprises a T head to the shaft. Each section of the wheel has a spring attached to the middle portion of the hub, and arranged to hold the section up to the wind when the latter is not too strong, and to yield when the latter is the case, and, by allowing the section to swing around toward the plane of the shaft, relieve the wheel, and thus protect it from damage. The wheel is arranged to receive the wind from behind the standard, on which its shaft is supported, and to dispense with a tail vane, which is required for keeping it in the winds, when arranged to take it in advance of the post.

Improved Animal Trap.

John M. Marberry, Johnsonville, Tenn., assignor to himself and John M. Palmer, of same place.—The wire cage has the usual entrances, and is attached to a bottom board. A small bait box, having wire sides and a hinged top, is secured to the bottom board by hooks and staples. The opening in the cage for the insertion of the bait box is closed by a prison box, which is attached to the cage by wire hooks. The box has a vertically sliding door which is held either closed or elevated by a sliding bolt. When the trap is to be put in readiness for catching animals, the prison box is detached from the cage, and the bait box removed through the opening thus uncovered. When bait has been put in the box, it is replaced and secured. The prison box is then attached to cover the opening in the side of the cage. The animal enters the cage, and thence passes naturally into the prison box with a view to concealment. The gate being lowered and secured by the bolt, the box may be removed to a place convenient for dispatching the animal.

Improved Brick Kiln.

Nelson Sickels, Newell, Iowa.—The walls inclosing the kiln are permanent. The lower portion of the bricks to be burned, in which arches are formed. These bricks are arranged close together in the direction at right angles to the arch, but with spaces between them the other way; and long bricks are placed across the arches a short distance above the bottom suitable for burning coal. The bricks above the arch bricks to be burned are arranged with spaces in both directions to be filled or partly filled with coal. Wider spaces are made between the stack of green brick and the walls, also for containing coal to be burned. They are divided vertically into several compartments by rows of bricks extending against the walls to separate the coal and keep it from falling to the bottom of the spaces as it burns. The arches extend through the kiln from side to side, and have the coal placed in them throughout their whole length to be burned throughout alike. The fires are started at the mouths of the arches, and kept burning moderately until the bricks get dry; then they are allowed to advance throughout the kiln in all the spaces as fast as necessary.

Improved Trumpet for Railway Heads, etc.

Richard E. Frye, Manchester, N. H.—The upper part to the lower side of the mouth is beveled, and a slide gate or valve is arranged under clips or guides forward and back over the beveled portion, to expand or contract the mouth, as may be required, the upper wall of the mouth being formed in the end of the slide. To adjust and secure the slide is a screw-threaded rod, passing through an eye stud on the top of the trumpet, and having adjusting and binding nuts arranged on each side.

Improved Grate Cleaner Attachment.

Adolph Tieusch, Memphis, Tenn.—The object of this invention is to provide fire place and other grates to which it may be applicable with a permanent attachment for cleaning them, or removing the ashes and cinders that accumulate in the bottom thereof. To this end a shaft is pivoted beneath the grate, and provided with laterally projecting arms or fingers that will work up between the grate bars as the shaft is rocked by a foot lever or other suitable device.

Improved Fire Extinguisher.

John Dillon, 424 Fourth avenue, New York city.—By suitable construction access may be obtained to the interior of the case, which is fastened to the wall of the room, by turning back the cover and turning down the upper part of the front, or both the upper and lower parts of said front may be turned down. A reel shaft revolves in the interior of the case, and is made with shoulders, to prevent it from having a longitudinal movement. One end of the shaft is tubular, and with its cavity is connected, close to the reel disk, the end of the wire-lined rubber hose, to the other end of which is secured a nozzle. The wire of the hose enables the water to pass through it freely, even when wound upon the reel. When the hose is wound upon the reel, the nozzle is inserted in a hole in the bracket. The tubular end of the shaft projects beyond the bracket, and is made conical to fit into the tapering hole in the globular end of the short ingress pipe, the other end of which is connected with the water pipe of the house. The short pipe is provided with a stop cock, which, by suitable mechanism, may be opened and closed by lowering and raising the said lower part of the front of the case. By other arrangements the front of the case may be lowered and raised without disturbing the stop cock, allowing the same to be closed while the front is lowered to shut off the water when about to wind the hose upon the reel. The latter operation causes the water to run from the said hose, so that it may be free from water when wound up. A ring groove is formed around the tapering part of the end of the shaft, so that the water may pass constantly from the pipe to the interior of the shaft, and thence to the hose, even when the said shaft is revolving.

Improved Curtain Fixture.

Edward M. Davies, Allegheny, Pa., assignor of one half his right to Francis J. Rebbeck, of same place.—The axle of a wheel is extended suitably beyond the brackets in which the roller turns, provided at its outer end with a screw thread, and produced with a square or triangular cross section. A spring is placed between washers, either inside or outside of the bracket, as desired. The washer adjacent to the bracket is provided with a round hole in the center, while the other washer has a square or triangular hole to fit on the axle trunnion and prevent the spring from getting worn. A check nut binds washers and spring together, and is prevented, by its washer, from becoming unscrewed. The check nut is used to regulate the tension of the spring on the bracket, so that the curtain is held in place in any position, in case the cord should stretch, break, or get off the roller.

Improved Pipe Joint.

William P. Valentine, New York city.—The object of this invention is to produce an improved pipe joint for water, steam, gas, and other pipes, by which they may be connected at any suitable point and under any angle without the use of fire or solder, by simple mechanical means. The invention consists of sockets made of two semi-shells, and fitted, by means of a projecting shoulder, to the recessed ends of the adjoining pipes. The sockets are cut with an outer screw thread, and firmly connected when placed on the pipes by a sleeve with right and left hand thread, which is screwed over it without altering the position of the pipes, while a leather or rubber washer in the sleeve secures the tight communication.

Improved Machine for Soldering Cans.

William D. Brooks, Baltimore, Md.—This invention consists in several improvements which have been tested by many practical experiments, and which greatly lessen the average expense of soldering the tops, caps, and sides of cans and have made it possible for unskilled hands to do the work rapidly and well.

Machine for Marking Letters and Canceling Stamps.

Chas. J. Goff and Elmer B. Hursy, Clarksburgh, W. Va.—This invention relates to mechanical means whereby stamped letter envelopes in the Post Office Department may be conveniently and rapidly canceled. The invention consists in a series of improvements by which a single person can, in a comparatively short space of time, do all the canceling required at any post office, thereby not only securing uniformity and thoroughness in the work, but great economy of time and cost.

Base Burning Stove for Anthracite Screenings.

Henry R. Robbins, Baltimore, Md.—This invention relates to an improved magazine stove, especially adapted for burning anthracite coal screenings and thereby utilizing what has been generally regarded as a waste product of the coal yard. The magazine, or cylinder for holding the coal, has a conical terminus formed of a narrow ring and vertical bars, the latter arranged at such distance apart as to prevent escape of the bulk of screenings between them, while allowing free access of flame and heat from the body of incandescent coal in the fire pot immediately below. Thus a degree or extent of combustion which would be difficult or impossible to produce and maintain, by means of the ordinary form of cylinder in magazine stoves is assured, while the area or surface of burning coal is largely increased and thereby a correspondingly greater degree of heat produced. The gas formed in the cylinder is fed down into the flame or burning coal by tubes, which are arranged directly over the fire pot so that the gas becomes highly heated before reaching the coal, and thus has its inflammable and combustible property increased. The invention also includes an arrangement of two annular registering slides with a fire pot open on the sides, whereby the combustion may be increased at the base or top, or both, of the body of screenings contained in the pot, as occasion or necessity requires.

Improved Transplanter.

Ara Race, Cheraw, S. C.—This invention relates generally to transplanters, but particularly to those which are used for the removal and transportation of cotton plants. The invention consists in combining a concaved plate with a reciprocating spade; in the construction of the spade with a convexity on the inner side and opposite the convexity of plate; and in combining a crooked slotted rod with the spade handle.

Improved Watch.

Louis Evans, Pittsburgh, Pa.—This invention consists in combining the winder post with the wheels and barrel, and also in the application of levers in connection with the wheel post and the dial wheel.

Water Heater, Warming Closet, etc., for Cook Stoves.

John O. Shriner and John Taylor, New Castle, Ind.—The object of this invention is to provide for household use an attachment for the ordinary cook stove which is adapted for heating a large or small quantity of water by means of a reservoir and a hollow cylinder placed in the stove pipe or drum, the two being connected by branched circulating pipes arranged in a peculiar manner. The invention also includes a warming closet which is arranged to slide on the cover and slide of reservoir.

Improved Fire and Water Proof Roof.

Tobias New, New York city—This invention relates to a peculiar construction of the roofs of buildings so that they may be always preserved in a waterproof condition, and yet allow the same to serve as a walk over which families or servants may travel in order to utilize the same for drying clothes and other useful purposes.

Improved Binding Attachment for Harvesters.

William M. and George H. Howe, Lansing, Minn.—This invention consists in combining a straw rope twister, a binding arm, a tucker and a cutter so that the rope is made and delivered automatically; also in certain subsidiary features of improvement which greatly add to the efficiency and utility of the binding attachment.

Improved Water and Gas Cut Off.

Eugene M. Morris, Baltimore, Md.—This invention relates to means for locking and operating the valve of a gas or water cock. It consists in combining with a valve rod connection a ratchet-flanged drum, a thumb-pieced detent slide, and a spring.

Improved Perspectograph.

Anderson R. East, Selma, Ind.—The object of this invention is to provide a simple and efficient mechanical apparatus by which to take the points or boundary lines of all visible stationary objects accurately and transfer them to paper on a sketch board. Two perpendicular bars extend from a bed piece. On one bar are two sleeves, the lower of which carries a horizontal arm, the further extremity of which is slotted to receive the second perpendicular bar. On the horizontal arm slides a vertical rod through which, at its upper end, passes another horizontal arm, which is attached to the upper sliding piece on the bar first mentioned. Pivoted to either sliding piece at will is a converging arm which carries one eye plate on a vertical staff. On all these portions except the swinging arm are marked scales. A single example of the mode of using the instrument will suffice to show its application. To operate by the use of the perpendicular scale and the horizontal scale on the upper sliding piece, or, in other words, to take field notes by latitude and departure, using the sliding scales, slide the horizontal scale to the top of the meridian, and move the scale of latitude (the vertical rod on the lower horizontal arm) to the extreme right. An object in the foreground to the extreme left and nearest to the observer is selected and regarded through the eye plate. The scale of latitude on the base is next moved till it comes in direct line with the eye and the said point. Then the horizontal scale at the top of the meridian is loosened and moved down till it also comes in direct line from the eye to the object, and the angle of incidence or the latitude and departure of the said point of the object is found at the intersection of the two scales. A horizontal scale on the plat board is moved until it cuts the degree of latitude of said point in the object, and a dotter is fixed to the angle of longitude or departure. By a gentle pressure on the dotter the point is carried on the paper. In this way the operation is carried on from object to object, and from point to point, until the entire field is gone over.

Improved Breast Pad.

Frederick Cox, Brooklyn, N. Y.—This invention consists of inflatable india rubber breast pads so constructed as to fit over the breast and not bear directly upon it. There is an annular cushion to bear around the base of the natural breast, and also a ventilating opening from the cavity. The device improves the form of the natural breasts by keeping them in the natural shape, instead of flattening and depressing them, as the common pads do; and they are more healthful, and retain their own proper shape better.

Improved Lard Cooler.

William J. Wilcox, Paterson, N. J.—To make a strictly prime article of lard, it is necessary to stir or agitate it to a certain extent while it is cooling after having been rendered or melted by heat. To this end it is proposed to employ two revolving agitators, turning on their own axes, while at the same time rotating around the axis of the tank. The agitators being on opposite sides of the axis of the tank, their action is rendered very nearly equal throughout all parts of the latter. Four of said agitators may be used as well, two being in a line at right angles to the line of the other two; but generally two only will be sufficient.

Improved Medicinal Capsule.

Peter Cauhape, New York city.—This method of making the capsule sacks of gelatin consists of dipping a ball in the gelatin in a liquid state, of such low temperature that a thin film will adhere to and solidify on the ball when lifted out, sufficiently to form an elastic envelope. This is pulled off the ball by the fingers, and placed in a mold, with the mouth upward, to be filled with the medicine, after which it is sealed up. By flattening the ball to a certain extent at the bottom, the accumulation of the material thereat will make the sack round, forming an article which is much better in respect of appearance, and is more acceptable to the public than the old elongated form.

Improved Medical Compound.

Edmund C. Lippincott, Eatontown, N. J., and Thomas R. C. West and James West, Brooklyn, N. Y.—This improved compound is for the cure of cancers, and is made of the juice of sheep sorrel, turpentine, and muriatic acid. The whole mass is reduced by evaporation to a thick, pasty state, when it is complete, and ready for use. It is applied to the parts affected in the ordinary way of using such remedies.

Improved Iron Pavement.

John Vandercar, Brooklyn, assignor to Martin Van Buren, New York city.—On the bottom of each section which is placed on the roadway is a flange, which is embedded in the foundation and prevents the section from getting displaced by the wear upon it. The sections, each with a tight bottom, have a broad surface, and may be made to lock together so as to support each other. The intermediate chambers are filled with concrete, which will harden by exposure to the air, or may be filled with sand or gravel so as to give a good foothold for horses. The chambers are eight or ten inches in depth. A pavement thus formed of sections, it is claimed, may be readily taken up for putting down water or gas pipes without injury.

Improved Kitchen Safe.

John B. Harrison and Josiah M. Harrison, St. Joseph, Mo.—This invention is an improvement in kitchen safes of the class in which spice drawers, dough kneading boards, and flour sifters are arranged conveniently for use. There are spice drawers, and a space provided with shelves, closed by a hinged door. A bracket supports a kneading roller and other articles. The hinged dough-kneading board may be adjusted at various angles to the front of the safe, thereby adapting it for convenient use. The top of the safe has a hinged lid which forms the cover of the conical hopper. The latter is designed to be a permanent receptacle for flour or meal, and has a sieve applied to its apex in such a manner as to be readily detached for cleaning, etc. Within the sifter is a rotary stirrer, the shaft of which is provided with a crank handle outside the safe. To control the descent of flour or meal into the sifter, a slide which forms the true bottom of the hopper is employed.

Improved Locomotive Drawbridge.

George Sicklesteel, Lapeer, Mich.—This invention consists of a strong frame, about as long as two spaces and two abutments of an ordinary bridge, mounted on wheels. The latter are so arranged and connected together that, the locomotive being run on the bridge and rested with each of its driving wheels on two wheels of the bridge and set in motion, its wheels will actuate the wheels of the bridge, and cause it to cross on the abutments. The bridge is always supported by two of the abutments, or more if made longer, so as to prevent it from tilting down between them. A movable bridge is thus provided which itself crosses with the cars, and leaves the spaces between the abutments free for the passage of vessels. The invention is intended to take the place of the drawbridges now used for navigable streams, and is calculated to save much time, both to the cars and vessels.

Improved Gang Plow.

Allison G. Cummins and John R. Cummins, McKinney, Tex.—The king bolt is extended upward and curved forward, and to its upper end is pivoted a lever, to which, at a little distance from its pivoted end, is pivoted the end of a connecting rod, the other end of which is pivoted to the tongue. By this construction, by moving the free end of the lever to the rearward, so as to lie along the curved upper part of the king bolt, the plows will be raised and locked away from the ground. When breaking up, or when bedding or ridging cotton or other land, or when doing other plowing that requires a rigid plow beam, a brace is used, the forward end of which is connected with the forward bolster, and its rear end is hooked into the hinged plow.

Improved Car Coupling.

George D. Spielman, Lancaster, Ohio.—This invention consists of a horizontal bar, arranged transversely to the car in a horizontal slot in the end of the drawhead, and pivoted at its middle to the latter. A hook on one end engages the end of a similar car on the drawhead of the other car to be coupled. The second bar similarly engages the end of the first mentioned bar. The slots in the drawhead are shaped so that the coupling bars can be raised at the ends having the hooks, and depressed at the other ends to allow the hook ends to rise up over the other ends for coupling. The hook ends of the bars are provided with chains to lift them up. The drawheads are also chambered out above and below the slots, for the coupling bars to receive the ordinary coupling links, and pin holes are provided for the ordinary coupling pins, so that cars with this improved coupling can be attached to others having the ordinary couplings. The hook of one bar encounters the end of the other bar not provided with a hook, and rises up on it because of its curved end, while, at the same time, the said end swings down in consequence of the hook at the other end rising on the end of the other bar. The bars extend into the slots far enough to receive the pivots behind the ordinary coupling pins, and they are slotted sufficiently for both of said pivots to allow them to swing upward and down, as needed for engaging and disengaging with each other. The coupling is very strong and durable, and will couple self-actingly, as well on curves as on straight lines, and will uncouple in case the cars run off or shift.

Improved Bag Fastener.

Scott Wellington, East Saginaw, Mich.—A strap of leather is made of such a length as to allow the gathered mouth of the bag to be readily passed through it, and its ends are riveted to a small metallic plate. Upon the side, edges, and center of the middle part of the plate, are formed lugs connected by two rods. To the outer rod are pivoted two pointed plates. of such a length that they cannot pass the inner rod, and which are designed to press the fastening strap down against the said inner rod. A narrow strap has its middle part sewed to the middle part of the strap first mentioned. The end parts of this strap are passed through staples attached to the main strap, and their ends are passed through the spaces between the lugs and rods. In using the tie, it is extended, and is passed over the gathered mouth of the bag to be fastened. The narrow strap is then drawn tight, and is held securely by the tongues.

Improved Window Screen.

John H. Thompson, Flemington, N. J.—This invention relates to the construction of screens for windows, and consists in an adjustable frame by means of which the screen is adapted to windows of different sizes. The frame is made in two parts, the sides being constructed so that the parts lap past and slide on each other, so as to keep the edges of the screen cloth tightly inclosed when the frame is extended. Strips are inclosed by the sides, forming a part thereof, to which the screen cloth is attached. Each piece consists of two parts, which are fastened together with the screen cloth between them, the end pieces only being grooved. The depth of the grooves in the ends of the frame determines the extent to which the frame may be extended without leaving an opening. The screen cloth is preferably made of wire, but ordinary mosquito netting may be used.

Improved Bridge.

Richard Long, Stelapolis, Iowa.—This invention relates to improvement in railroad and other bridges of shorter spans, with wooden arches, and consists in the use of stirrups suspended from the arches which carry the cross beams, together with longitudinal stay rods, which connect the ends of the arches.

Improved Reversing Valve for Steam Engines.

Philip T. Brownell, Elmira, N. Y.—Steam is admitted through an aperture, in a cup which fits on the receiving chamber. Pipes connected with this chamber convey the steam to the several cylinders. The valve receives a rotating motion from the crank shaft, and the latter is supported by a spider, which is fitted to the upper edge of the chamber. Upon the lower end of the shaft is a cross bar, with a toe at the end, which takes hold of lugs on the top of the valve for revolving the same. The valve is a hollow shell, having partitions and a hollow tubular center. The cylinder slides in the center, and has a horizontal partition which separates the live from the exhaust steam. The center has two long slot ports, and the sliding cylinder has two corresponding therewith in size and position. The cylinder is given a slight sliding motion, which allows either pair of these ports to register for admitting steam and exhausting it. The sliding cylinder revolves with the valve. When one pair of ports are admitting steam, the opposite pair are exhausting it; and this action is instantly reversed by a slight movement of the sliding cylinder.

Improved Folding Satchel or Box.

Lorenzo M. Gillet, New York city.—This invention is a small satchel or box for travelers that can be folded up in a small, compact package when empty. The bottom, sides, ends and top, may be cut in one piece from pasteboard, leather, or other suitable material, or said parts may be made separately with joints to bend at the angles of the box for adjusting it or setting it up for use. The sides and top fold against the edges of the ends and project a little beyond them, so that staples on said ends will project through slots to fasten the ends and sides together by pins through them, or any other equivalent arrangement. The top will overlap one of the sides and form a lid for opening and closing the box or satchel. Any ordinary trunk or satchel handle may be attached, or a shawl strap may be buckled around the box for carrying it.

Improved Combined Ash Box and Sifter.

John D. Heins, New York city.—This invention consists in the arrangement of a sieve and close ash box in a large inclosing box, whereby wood may be conveniently removed, and also ashes mey be sifted without allowing any portion to escape. The wood and coal are supplied to chambers by raising the hinged cover, and the former may be removed without disturbing said cover by turning down a door which is hinged at the front and is of a width less than the depth of the box. The sieve is worked by a detachable handle, to be introduced through the holes in the case. After the ashes have been sifted out, the sieve can be taken out when the handle has been detached, and emptied into the coal chamber, and the ash box can be withdrawn from time to time to carry the ashes away.

Improved Ditching Machine.

John M. Dunn and Murdoch M. Dunn, Erin, Miss.—This invention has for its object to improve the construction of the machine for which letters patent No. 119,384 were granted to John M. Dunn. The frame may be slid to adjust the machine laterally to work in any desired part of the excavation. The wheels and axle may be swung forward to lower the machine into working position, or swung back to raise the machine for passing from place to place. The device may be readily secured in place when adjusted, and is raised or lowered by suitable mechanism connected with the wheels. The plow may also be raised and lowered and adjusted. A wheel made with a wide tread projects upon one side of its body. In the angle between the body and rim of the wheel are secured small plates, arranged radially, and which serve as buckets to carry up the soil thrown into the cavity of the wheel by the plow. A guard plate keeps the earth from falling from the ascending buckets. As the buckets reach the upper part of the wheel, the soil falls from them into an inclined spout attached to the frame, where it is received upon the wings of a wheel, by which it is projected upward and outward to fall upon the ground at the side of the ditch. The earth from the wheel is caused to fall at the desired distance from the wide wheel by a shield against which it strikes. The winged wheel is so arranged that it may be driven by the advance of the machine.

Improved Pantaloons.

William O. Linthicum, New York city.—The object of this invention is to render pantaloons more elastic, and the fastening more durable than they have hitherto been; and it consists in an adjustable elastic strap attached to the waistband or top of the pantaloons behind, and in a plate fastening in front. By means of this elastic strap, the pants are made self-adjusting to the waist or abdomen, and are rendered easy and comfortable to the wearer.

Improved Heating Stove.

Edwin A. Osborne, Charlotte, N. C.—The ash pit is deeper at the back than at the front part, to prevent the ashes rolling forward, and there is an opening in the bottom at the front, with a collar cast around it for receiving the pipe through which the air is admitted to support combustion in the stove. The supply of air is regulated by a damper, which has an elevation, to prevent the falling of ashes into its vent, and a thin narrow handle, which extends from the inside of the ash pit through a narrow opening in the front. This is all cast in one piece. The pipe extends through an opening in the floor corresponding with the position of the front of the stove, and at the lower end below the floor is a wicker work of wire, with a tin or sheet iron bottom, as a spark arrester. The covering for the ash pit is a common movable cover. The object of the invention is to obtain the supply of air outside the room to be heated, thus preventing currents, preserving the uniformity of the temperature, and requiring less fuel.

Improved Middlings Purifier.

Morris Sower, Princeton, Ill., assignor to Sower Brothers, same place.—An inclined frame is placed within the main frame, and is made a little shorter than the latter, so that it may have a longitudinal movement. It is actuated by an eccentric in one or both directions, supporting springs always bringing it back promptly when released. The frame to which the bolt cloth is attached is suspended within the vibrating frame by flexible straps. By this arrangement each movement gives a sudden jar to the cloth frame, which keeps the cloth clean without the use of brushes. The middlings are fed to the cloth frame by a roller or other suitable feed from a hopper, which is placed above the upper end of the frame. Below the discharge opening of the hopper a spout leads into an expansion chamber, from the lower part of which a short spout leads out through the rear end of the box, which is provided with a trap door. From the expansion chamber an opening is formed into the fan chamber. The air is so directed that it passes up through as well as along above the bolt cloth, while a third current goes through the middlings as they fall from the hopper. By this construction the air drawn through the machine by the fan carries the light impurities with it. Any of the middlings that may pass through the spout with the air settles in the expansion chamber, and may be drawn off when desired.

Improved Plow.

Isaac M. Fork, Belton, Tex.—This invention has for its object to furnish an improved plow, so constructed that it will scour and keep bright in the stiffest and most sticky prairie soil, and will thus work without clogging where ordinary plows cannot work. The invention consists in an improved plow plate, formed of a single piece of iron or steel, with its point in the form of an isosceles triangle with a rearwardly inclined land side flange. The angular line between the land side flange and the mold board is concaved upon the arc of a circle about six feet in diameter. The mold board is convexed, so that a line drawn from its rear corner to the point of intersection of the said angular line and the point may be upon the arc of a circle of about twelve feet in diameter.

Improved Sash Holder.

John X. Miller, Chester, Pa.—This invention consists in proving the window sash at both sides with triangular recesses, into which strong band springs are placed, with forward projecting rollers attached thereto. These rollers bear against one guide strip of the window frame, so as to hold the sash by its friction on the other guide strip in any position in which it is placed. For locking the sash in closed position, so as to prevent its opening from the outside, small catches are attached to the lower parts of the outer guide strips, which catches engage a corresponding recess of the sash, while the necessary play of the sash for engaging and disengaging it from the catches is obtained by recesses at both sides.

Improved Gear Button for Flour Packers.

Lewis Creveling, Akron, O.—The object of this invention is to supply, in the place of the button at present in use, one which controls more exactly the throwing out of gear of the machine, and packing the barrels and sacks more evenly as to weight. This invention consists in the application of a T rail to the upright frame piece of the platform on which the barrels and sacks are placed, with a button slotted to correspond, which may be set firmly thereon by means of a thumb screw in the position required to pack the barrels or sacks, and then throw the machine out of gear.

Improved Corn Husking Implement.

Jacob F. Schmeltzer, Manteno, Ill.—The object of this invention is to furnish to farmers an improved corn husker, which is made easily adjustable, to be used in cold weather with or without mittens or gloves, and be adapted for different sizes of hands. The invention consists in making the handle plates sliding in each other, and fastening them rigidly, by a set screw, in the position desired to fit the hand.

Business and Personal.

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2nd Hand Portable Engines, 8 to 20 H.P., thoroughly overhauled, good as new, less than Half Cost. I. H. Shearman, 45 Cortlandt St., New York.

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ANSWERS TO CORRESPONDENTS

C. S. A. can improve his rancid butter by the process described on p. 368, vol. 26.—J. P. W.'s correction to the problem on p. 11, vol. 30, has been anticipated.—W. W. will find directions for making earthenware and porcelain on p. 3, vol. 30.—C. H. C. will find recipes for yellow and blue lights on p. 58, vol. 30.—For answers to your other queries, consult the booksellers who advertise in our columns.—J. W. C. should address the makers of emery wheels.—S. D. L.'s answer to the ship and cannon problem is correct.—C.P.B. Jr.'s query is incomprehensible.—L. G. G. will find directions for transferring engravings on p. 138, vol. 30.—G. M. H. will find a description of the preparation of platinum sponge on p. 330, vol. 25.

J. W. H. asks: 1. Can a paper pulp be used instead of several layers of paper in making images for the stage? A. Probably it could. 2. How can I make the pulp? A. Old paper may be made into a pulp with a solution of lime and gum or starch, pressed into the form required, coated with linseed oil, and baked at a high temperature.

J. M. says: I have a boiler 42 inch by 20 feet; it is two years old and there are two holes eaten in it by rust, right over the fire; they are eaten from the inside. What can I do to prevent rust doing any more damage? A. If the corrosion be caused by scale, change the feed water, or use some substance that will prevent the formation of scale.

W. L. N. says: I find that all matter that makes scale in a boiler is at one time a floating scum on the water, till, by attracting more particles, it becomes heavy and precipitates to the bottom. I propose to take that scum from the boiler while in the fluid state. Is the idea a good one? A. It is not a fact that the principal incrustations in a boiler are caused by substances that float on the water as a scum.

D. C. asks: 1. What will be the approximate velocity of steam at 200 lbs., flowing into another body of steam at a pressure of 100 lbs. through a pipe 3 square inches in area and 3 inches in length? What would it be under the same conditions if discharged into steam of 50 lbs.? Would not the work performed by the steam on entering the respective pressures be about equal? Will Professor Rankine's formulas, given on p. 113 of your volume 29, apply to these cases? A. The rules given in the article referred to are as accurate as any that have been deduced. 2. Would a polished plate with no uneven surfaces encounter much loss of power if revolving rapidly in steam at a high pressure? A. No. 3. How is it that steam will expand to twice its volume and half its pressure when the heat of one volume with a pressure of 2 is not equal to that of 2 volumes with a pressure of 1? A. The law that the volume is inversely as the pressure is only true of a perfect gas whose temperature is maintained constant during the expansion.

A. B. says: 1. It is stated that daguerreotypes may be made by the electrotype process. Can a printed page of a book be made in a similar way? A. Electrotype copies of daguerreotypes can be made. 2. It is said that a sheet of paper folded into two leaves is called a folio, into four leaves a quarto, etc. What is the size of the sheet so folded? A. It differs greatly, being elephant folio, demy folio, etc. 3. Is magneto-electricity the same in kind as the electricity produced by any of the numerous forms of the galvanic battery, such as Grove's or Bunsen's? A. The electricities obtained from magneto-electric machines and batteries have similar heating, lighting, and electrolytic powers, but differ greatly in quantity and intensity.

H. J. B. asks for a recipe for plating small articles of silver without a battery. A. The metallic surface intended to be silvered, having been well cleaned, is rubbed, by means of a smooth cork, with a with a mixture of 1 oz. chloride of silver, 1 oz. common salt, ½ oz. chalk, and 3 oz. carbonate of potash, made with water into a creamy paste.

R. J. asks: 1. What are the proper proportions of salt and ice to freeze ice cream? A. Twice as much pounded ice as rock salt, but the proportions may be changed somewhat without destroying the efficiency of the mixture. 2. For keeping ice, which is best, dry or wet sawdust? A. Dry saw dust. 3. I have a large amount of charcoal and ashes, being the *debris* from a furnace. Will it be of more value as a fertilizer, or as an underlying bed for an ice house? A. It depends upon circumstances; but ordinary coal ashes and charcoal not being remarkable fertilizers, you might better use in the way indicated.

A. B. C. asks: 1. What is shown by chemical analysis to be the composition of coal? A. The Pennsylvania anthracites consist of 1·34 per cent water, 3·84 per cent hydrocarbons, 87·45 per cent carbon, 7·37 ash. The percentages of these constituents vary greatly, the bituminous coals having more hydrocarbons and volatile combustible matter with less fixed carbon. 2. Is fire or flame a material thing? A. The flame of a candle or gas burner is composed of gaseous matter in a state of ignition. This gaseous matter, generally speaking, consists of various compounds of carbon and hydrogen. By carefully looking at a flame, it will be found to consist of three parts: the lowest of a bluish color, where the hydrogen is uniting with the oxygen of the air. The heat given out by their chemical union is very great, and raises the particles of carbon to white heat. These white hot particles give out the light. Around these is a thin shell of carbonic acid, and the spent gases arising from the combustion.

C. M. F. asks: 1. Has the use of the microscope any injurious effect on the eye? If so, how can I avoid it? A. It has when frequent intervals of rest are not permitted to the eyes, or when the observations are prolonged for several hours at a time. A little practice will enable the observer to keep both eyes open, while looking through the eye piece with one eye, and at the same time see as distinctly as if the other eye were closed with the hand. This, and using the left and right eye alternately, afford great relief. 2. Is there any way of throwing the light upon an opaque object under the microscope, other than the lens? A. By means of a Lieberkuhn, which is a highly polished speculum of silver, and reflects the light down upon the surface of the opaque object. 3. Will the use of the lens injure the eye, and why? Will the use of the mirror by lamp light injure the eye? A. Used properly, with a lamp which does not flicker, in such a way as to get a good illumination without either blinding the eye with its intensity, or taxing it by too long an observation: both the lens and mirror can be used without any injury. 4. If I should replace the three smallest lenses of a microscope by three others of higher powers, would it answer the same as a higher priced instrument, without altering the other parts? A. It would answer the same purpose, provided the other parts would give a corresponding delicacy of adjustment of the focus and of the stage.

C. R. M. asks: 1. Where is carbon black diamond found? A. In Brazil. 2. Could arsenic be substituted for Paris green in the poisoning of potato bugs? A. Arsenic is equally or more poisonous, but experiment would tell whether the bug would as readily eat a white powder as one which is of the same color as the leaf.

C. F. D. asks: Is there anything which will cement broken coral? A. Apply powdered sandarac or mastic with a small brush, heat until it melts, and press the broken pieces together. Or mix boiled linseed oil and red lead; and after applying, let it harden quietly for some weeks.

J. D. W. asks: 1. Is there an easy method of extracting pure hydrogen from house gas? A. Large quantities of pure hydrogen can be easily and simply made from other materials, but from house gas its extraction is difficult. 2. How can I get more pressure on house gas as it comes from the burner? A. The plan usually followed is to receive the gas from the mains in a small gas holder, and connect this with the burners. 3. What causes it to explode? Is it dangerous to handle 15 or 20 gallons at a time? A. Mixture with air. When the air is prevented from mixing with the gas there is no more danger than in handling gun powder or other explosive.

H. J. B. says: I have made an explosive powder composed of 2 ozs. chlorate of potash, 1 oz. prussiate of potash, and 1 oz. white sugar, which has 3 times the force of common gunpowder. Is it dangerous? A. This powder has been known since 1849. It has the following advantages. It can always be obtained of uniform strength and quality, by weighing out the proper quantities of each ingredient. It does not attract moisture and is not acted upon by exposure to the air. The manufacture requires but a short time, the projectile force is far greater, and the powder need not be granulated. Its disadvantages are that it is more readily fired than ordinary gunpowder, therefore more dangerous, that its manufacture is very expensive, and that during its ignition it acts so very strongly upon iron and steel that it can only be used in bronze ordnance, and in the filling of shells, etc.

B. F. C. says: In your pamphlet containing the United States patent law and other information, you give a recipe for making liquid glue which is as follows: "Dissolve gum shellac 3 parts, and caoutchouc 1 part, in separate vessels, in ether free from alcohol, applying a gentle heat. When thoroughly dissolved, mix the two solutions." I have tried to make some of this glue, and could not make the rubber dissolve. I had no trouble with the gum. Do you think the fault was in the ether? What kind of rubber is required? Will an old car spring do? A. Use rectified sulphuric ether that has been washed to remove alcohol and acidity, and india rubber that has not been vulcanized. When the caoutchouc has become well softened by the ether, break it up into small pieces and stir well until a homogeneous soft mass is obtained. It will be as well to cut the rubber into small pieces before pouring the ether on them, but the mass must be frequently and well stirred. Pour the solution of shellac into that of the rubber, and incorporate them thoroughly by stirring.

D. E. asks: In your issue of January 10, 1874, a correspondent gives a problem with a diagram. From his statement I infer that the annular space, *d* 4, is airtight. This being the case, how is it possible for either piston to fall, even though the balance of the cylinder 5 contains only air and not a denser fluid? A. Under this supposition, it is impossible for motion to take place.

S. asks: Is there a simple and easy method of extracting perfume from flowers, etc.? A. Yes. The fresh flowers are placed between layers of cotton wool, saturated with sweet olive oil; in some cases, pure lard is employed. The essential oil thus obtained is separated from the sweet oil by agitation with strong and highly rectified alcohol. The essential oils of jasmin, sweet violets, hyacinths, etc., are obtained in this manner The perfumed extract is then prepared from the essential oil by dissolving it in very pure alcohol; and in order to blend the mixture and render it mellow, it is kept several months in a bottle before being sold. This also answers A.

M. B. C. says: I have a building of frame, 70 feet long, 38 feet wide, 2 stories high: the second story is used for drying stock. It is lined and ceiled with hemlock floor boards, and heated by steam, with 8 rows of 1 inch pipe extending across one end and 48 feet along each side, making about 1,000 feet of pipe. I desire to have my stock dry faster; can I accomplish this by making an opening in the floor of about 144 square inches, connecting with a wooden chimney at end of building 12 inches square and extending 3 feet above the roof? Would it be practicable to box in about 48 feet in length of the pipe along one side for heating the air as it comes in? And would there be any draft inwards by admitting air from outside, by an opening at one end? Or must I run a tube down to the bottom of next room to secure a draft? Will such an arrangement supply the room with sufficient warm dry air, and also relieve it of the damp air by the first named arrangement in the floor connecting with the wooden chimney? A. There is a popular fallacy in connection with this subject of drying by heated air, that needs correction. It is supposed generally that to dry anything we have only to confine air in a close room and then heat it to a certain temperature, and keep it so for an indefinite length of time. The true theory is as follows, and the best success is assured when our practice accords with it: Air has the greatest capacity for absorbing water when expanded by heat of the sun or otherwise; but when saturated, is incapable of further absorption. When it has the appearance of being the most dry, it is then much charged with water, and is still absorbing water from everything it touches; when it has, on the contrary, the appearance of being very wet and humid, it is not much charged with water and is giving off that which it has. In regard to this case, it is evident that by charging the air in the room with caloric, we prepare it for the absorption of water, and so cause it to have a drying power upon the stock; but when it is fully saturated with the water it has taken up, its drying power is overcome and its action is passive. If, however, we drive this air out of the room and take in fresh air, we can again expand it with heat, and again give it a drying power equal to its capacity for the absorption of water; and thus proceed more rapidly with the operation of drying the stock. Instead, however, of having a continuous current passing through the drying room, it will answer as well to periodically open all the windows for a short time, and let the air be totally changed in the room; then close them, heat up again, and keep them closed for a period sufficient to fully saturate the air with water. This might be determined by the feeling of dryness or humidity which the air presents, not opening the windows until the air appears very damp; and a few trials would soon determine the length of time best to work with one volume of air.

D. C. B. asks: 1. Can you give me recipes for making transparent colors? A. It will be cheaper and more satisfactory for you to buy them. 2. How can I make a good transparent varnish for brasswork? A. With copal and alcohol.

W. D. asks: Where is the deepest artesian well in the world? What is its depth? A. The deepest artesian well of which we have seen an account is at Louisville, Kentucky. Its depth is 2,086 feet.

G. asks: 1. How shall I construct a fire escape, suitable for a lady traveling? A. Try your inventive skill. 2. How shall I draw an oval? A. See p. 299 vol. 29.

T. & H. ask: How can we make a joint in a brass pipe, so that it can be bent in any direction? We have been told of a knuckle joint, but no one knows what it is. A. The joint consists of a ball and socket, the latter being something more than a hemisphere.

G. L. H. asks: How can I construct a rain gage? How can I tell the amount of evaporation? A. The rain gage ordinarily used consists of a cylindrical vessel having a funnel-shaped cover, in which there is a very small hole. A glass tube connected to the bottom of the vessel shows the hight of water. In accurate operations, it is customary to ascertain the evaporation daily, usually in a separate vessel.

J. McJ. asks: Is a house properly rodded for conducting off lightning, where the rod is fastened to the finials of the roof by means of copper wire not insulated? A. It is correct to attach the rod directly to the roof or building without insulators. But no building can be said to be properly rodded or protected against lightning, unless the lower part of the rod or terminal under the ground is made quite extensive. The extremity of the rod should connect with masses of old iron, or iron ore, or coke, or charcoal, laid in trenches, or the rod itself should be elongated and carried off one hundred or more feet from the building, and put in connection with water, if possible. The particular method of attaching the rod to the building, whether with or without insulators, is of far less importance than the terminal arrangements of the rod. The golden rule for safety is: "Provide the largest possible area of conducting surface for the terminal of the rod."

C. W. C. asks: 1. How can I make the best black writing ink? A. What is the best black ink is probably a matter of opinion; but you will find a good recipe on p. 208, vol. 29. 2. How can I make red ink? A. Dissolve pure carmine in caustic ammonia. 3. How can I estimate the horse power of a boiler? A. The term "horse power of a boiler" is so indefinite that we cannot give you any good rule.

G. H. B. asks: Is rolled sheet zinc pure metal? If composition, what are the proportions and ingredients? A. It ordinarily contains small quantities of lead and iron, a little tin and cadmium, and sometimes traces of arsenic, copper, carbon, and sulphur.

J. L. H. asks: 1. How can I readily tin iron rods ½ inch square and from 12 to 18 inches long? A. Cover the rods with muriate of zinc, and put them into a tin bath. 2. What is the process of electroplating, access being had to a telegraph battery? A. You should consult some standard work on the subject, as we have not space for the details in these columns.

M. W. B. asks: What causes the light and dark stripes on a ceiling, the light stripes corresponding with the laths and joists, and the dark stripes with the space between? A. The moisture in the wood.

F. M. S. asks: In the manufacture of gun cotton, is the use of chemically pure acids imperative? A. No. The commercial acids are frequently used. 2. What proportion and strength of acids should be used? A. 105 parts by weight of sulphuric acid at 66° B., to 50 parts of nitric acid at 48° B. 3. Is gun cotton an article of manufacture or commerce to any extent, and has it been put to any practical use? A. It is used for projectiles, in the art of photography, and in surgery. 4. Is there any mechanical arrangement by which the electric current of high tension can be reduced to a more voluminous one of lower tension? A. Yes.

G. A. P. says: I am running a grist mill with two sets of bevel gears, using about 20 horse power. I wish to throw the gears out and use a belt. Will a 20 inch belt be sufficient, if it be driven from a four foot to an eight foot pulley? The belt will run 720 feet per minute, on upright shafts. A. We think the belt will be large enough. We have already given rules by which the proper width of belt can be determined approximately.

D. N. C. R. asks: About what size would a boiler require to be to run an engine 300 revolutions per minute, the size of the cylinder being 5 inches stroke and 3 inches diameter? A. It would probably require from 25 to 40 square feet of efficient heating surface.

J. F. D. asks: How can I make small articles of india rubber? Is there a book on the subject? A. Hancock's "Manufacture of India Rubber" will give you considerable information on the subject; but probably you would best acquire the art by practical experience at a manufactory.

A. S. S. asks: Is this the correct way of finding the actual horse power of a high pressure steam engine? Diameter of cylinder 7 inches, length of stroke $1\frac{3}{4}$ feet, revolutions per minute 80, with steam power on piston at 60 lbs. per square inch, and allowing $1\frac{1}{2}$ lbs. per square inch for friction: $7\times7=49\times58\frac{1}{2}=2866\frac{1}{2}$. The length of double stroke is $3\frac{1}{2}$ feet$\times80=266\frac{2}{3}\times2866\frac{1}{2}=764400\div42017$ $=18\frac{8094}{42017}$ horse power. A. The solution is correct for the assumed *data*.

S. asks: 1. How thick would iron have to be to withstand a pressure of 30 lbs. to the square inch? A. It would depend upon the form of the vessel. 2. I have a small steam engine. Bed plate is 15½ long by 3 inches wide, with a 10 inch wheel. Cylinder is 1½ inches diameter by 3 inches stroke. What would be the horse power, with 30 lbs. of steam to the square inch and running as fast as possible without injury to the engine? A. Multiply the pressure on piston in pounds, by speed of piston in feet per minute, and divide by 33,000. 3. How can I calculate where to drill the hole where the shaft goes through in the eccentric, so as to give the right travel to the slide valve? A. Make the distance, from center of eccentric to center of hole, half the travel of the valve. 4. What is the best way to seat or grind the slide valve so as to make it fit steam tight to the cylinder? A. Use a scraper to face off the valve and seat. 5. What is the best polish for iron castings which are tolerably smooth? A. Fine emery will answer well for the iron.

W. L. P. asks: 1. Who was the engineer of the Suez canal? A. Ferdinand de Lesseps. 2. What is its length, breadth, and depth? A. About 100 miles long, 300 feet wide at the top, 100 to 150 feet wide at the bottom; average depth 24 feet. 3. In what years was it commenced and completed? A. Commenced in 1854, and completed in 1869. 4. What was its cost? A. About ninety million dollars. 5. Does it pay? A. It pays its expenses, but has not yet yielded anything to its original shareholders. See p. 119, vol. 30.

C. W. A. asks: 1. How many grains of chloride of gold will a given number of grains of metallic gold make? A. This is found by first adding together the combining weights of chlorine and gold, and dividing the result by the combining weight of gold alone. Thus Cl=35·5, Au=196, Au Cl=231·15. $\frac{231\cdot5}{196}=1\cdot18+$. Therefore one grain of metallic gold will make 1·18+ grains of chloride of gold. 2. Are iodide and bromide of potassium soluble in a mixture of equal portions of absolute alcohol and *ether. sulph. com.* to the extent of 6 or 10 grains to the oz. of the mixture? What is the process? A. This is a question which you can determine by experiment. Agitate the powdered bromide or iodide in the mixture of alcohol and ether, carefully applying heat if necessary.

E. R. W. asks: What two substances, elements or compounds (ice and snow excepted) possess the least amount of friction when brought into contact with hard substances? A. It is not possible to answer this question in its present very general form, because it is necessary in the first place to know how the substances are to be brought in contact, and secondly, what the hard substances are, for much depends upon the adaptation of lubricating materials to the circumstances under which they are to be used. The softer greases, as oil, hog's lard, etc., diminish the resistance under small pressures more than under high pressures. The harder greases, as tallow, soft soap, and mixtures of grease and plumbago, produce less effect with small pressures than with large ones.

J. H. S. asks: What do the words sin., cos., and tang., and the sign $\sum$, in algebra mean? A. Sin. = sine of an arc or angle. Cos. = cosine. Tan. = tangent. $\sum$ = the sign of the summative, and means that terms of a series are to be added together. Thus $\sum(x)$ = sum of all the terms of the series of this general form: $x+x'+x''+x'''+$ etc. 2. Would it be profitable to construct a winged steam valve, so as to give the engine power from the valve instead of requiring power from the engine to run it? A. As we understand this question, it would be very profitable, if it could be done.

L. P. C.—For replies concerning the assignments you mention send your address to Munn & Co., and send ten dollars.

S. M. M. asks: Is there an instrument by which any mineral of value in or under the ground may be found? If there is anything of the kind that you know of, please inform me. A. The presence of iron ores below the surface of the ground can in many cases be determined by a magnetic needle; but there is no instrument for indicating other metals.

G. S. D. asks: Is a process by which milk can be preserved for several weeks, the cream separated and churned at convenience into an extra quality of butter free from incipient rancidity, therefore little prone to deterioration, patentable? A. Probably it is.

E. L. asks: How or where are the wires concealed or put out of sight in connecting an electric burglar alarm with the doors and windows of a dwelling house? A. In new houses, the wires are frequently placed behind the plastering. But ordinarily they run long the base boards of the apartments.

F. H. B. asks: What will remove ink and fruit stains from paper, linen, etc., without injuring the fabric? A. For ink, rub the spot with a weak solution of oxalic acid. For fruit stains, make a mixture of ½ lb. chloride of lime and 3 pints water, add 7 ozs. crystallized carbonate of soda dissolved in 1 pint of water. Mix thoroughly, allow to settle, and pour off the clear liquid. This will remove fruit stains from linen.

J. F. asks: What is the correct theory about the formation of ice? Does it form from the bottom of the water or from vapor escaping and congealing on the top? A. It forms at the top, by the production, at the freezing temperature, of innumerable crystals, which interlace one with another until at last there results a solid mass.

W. H. W. M. asks: 1. Can sugar and sirup be made from rags and sawdust by the aid of sulphuric acid? A. Yes. 2. By pouring sirup into the tea, the tea turns a black color; does it denote that the sirup is made from rags, etc.? Would the action of the acid in the sirup operate on the tannin in the tea, and produce the black color? Will not good sirup without acid affect the tea in the same manner? A. It is more likely that there was a trace of iron present, which formed a tannate of iron and caused the inky appearance. Sirup manufactured in a proper manner will not blacken tea. 3. The following is another test: Mix the sirup with a solution of muriate of baryta. If there be any acid in the sirup, its presence would be denoted by a white precipitate. This is reputed to be a sure test. I have tried the tea test myself, and it became of such a black color that I could not see the bottom of the saucer. A. It is true that a solution of muriate of baryta will detect the slightest trace of sulphuric acid, and form with it an insoluble white compound.

C. O. E. asks: 1. How can I silver plate iron? How can I make the best silver solution for iron? A. Wash in weak lye to remove grease. Dip into weak *aqua fortis* to remove rust. Scour with a hard brush and fine sand. Then, having fastened to a wire, dip in strong nitric acid and, as quickly as possible, afterwards in the silver bath. This may be made by dissolving silver in pure *aqua fortis*. Afterwards a solution of cyanide of potassium is added until nothing more is thrown down. The liquid is poured off, fresh water added and poured off several times until the cyanide of silver is well washed from the acid, and then solution of cyanide of potassium is added until it is all dissolved again. A silver plate is used for the other pole of the battery. 2. How can I get different colors of gold by galvanic plating? A. The process is too complicated to be published in these columns. Consult a good book on electroplating. 3. How can I plate iron with nickel? A. Make a bath of ¾ lb. of the double sulphate of nickel and ammonia to a gallon of hot water. Use a Smee battery. The articles to be plated require, according to the power of the battery, from six to ten hours, but the average will be eighhours. After being plated, they are washed with hot water and polished on a cloth buff with crocus, rouge, Vienna lime, or other polishing powder, and oil. Two points must be attended to: 1. To have the solution always kept neutral; 2. to clean the iron perfectly, which may be done with muriatic acid.

A. B. C. asks: How can I make a cheap and efficient induction battery for medical use? A. By wrapping a coil of stout insulated wire around a core of soft iron, and connecting the ends of this wire with a galvanic battery. Around this coil another coil consisting of fine insulated wire is wrapped, and of much greater length. The ends of this wire are the poles to be used. An arrangement like a toothed wheel must be introduced somewhere in the circuit for making and breaking the connection.

D. B. W. says: In the SCIENTIFIC AMERICAN, December 3, 1873, I find a recipe for making a rubber cement by dissolving rubber in benzine, which fails to work; the rubber does not dissolve. Can you tell what the difficulty is? A. Try pure unvulcanized rubber and stir the ingredients well together frequently, with a stick or knife. The benzine must be highly rectified and pure. Sulphide of carbon is also a solvent of rubber.

E. B. asks: Is there a sure and simple test for distinguishing between genuine and artificial butter? A. There are sure tests, but they are too complicated for any one but a practical chemist to apply. For answers to your other questions, consult a stationer.

H. W. J. says: 1. I wish to make a telescope with a four inch lens, 72 inches focus. What must be the size of my eyepiece? What can I see with such a telescope? A. You can apply an eyepiece of one inch focus; but unless the object glass be achromatic you cannot employ the full aperture, nor in any case have a very satisfactory field of view. 2. How can I polish articles that I have silver plated, and how many Callaud cells will be necessary? A. You can polish silver with fine chalk, applied with chamois leather or a soft woolen rag. For plating a few small objects, one or two cells are sufficient.

P. H. M. asks: Is the cause of the existence of the Gulf stream known? If so, what is it? A. It is caused by the heating of the waters of the Atlantic ocean under the equator, which makes them lighter, and causes them to flow over the top of the water lying to the northward, this water flowing in below towards the equator.

F. C. B. asks: Is there any process to restore blackberry wine or any other liquid that has become musty by putting it in a musty barrel? A. Mustiness in wine, it is said, may frequently be removed by violently agitating the wine for some time with a little coarsely powdered charcoal, freshly burnt, or even some slices of bread toasted black. A little bruised mustard seed is occasionally used for the same purpose.

E. S. M. says: I am about to construct a reflecting telescope, the mirror being formed by silver chemically deposited upon glass. Can you give me some recipe for a solution to deposit the silver in a proper form? A. There are various methods of depositing silver upon glass. Here is one which you may make available by practice: A solution of gun cotton in caustic potash is added to a solution of nitrate of silver, followed by sufficient strong liquor of ammonia to redissolve the precipitate. The resulting argentiferous liquid is applied to the glass which is then slowly heated over a water bath until effervescence ensues and the deposit of silver is complete. Let a chemist prepare the solution of gun cotton, which requires care in handling.

G. E. R. asks: What substances are used with extract of logwood to make a cheap red color? A. In a decoction of three pounds sumac, the goods are steeped over night, and then spirited at 3° Twaddle; wash and work through a decoction of three pounds Lima wood and one pound logwood for thirty minutes, then raise with a gill of red spirits; work for fifteen minutes more; wash out and finish.

S. asks: What colored light is best for persons to read by, and how can I impart that color to lamp chimneys? A. Blue. It can be painted over with a thin coat of Prussian blue.

H. R. R. asks: 1. How can a handsome purple color be made for druggists' show bottles? A. Make a solution of permanganate of potash in distilled water. 2. Can I make two different colors in the same bottle, that is, two colors that will not mix, as, for instance, red and green? A. Aqueous solutions alone will not answer. Dissolve some sulphate of nickel for the green, and upon this pour some oil colored with cochineal.

F. P. C. asks: Is there any satisfactory way of testing adulteration of linseed oil with cotton seed oil? If so, what? A. We are not aware of any reliable experiments on this point. Consult some good practical chemist.

W. says: I have bought 100 square inches of water, to be taken from the raceway under a 3 feet head. When the water is used, the surface in the pond and raceway lowers about 4 inches. If I draw my water through a 10 inch square hole, how deep must I put my flume, so that I can get my 100 inches of water and no more? A. See article on "Friction of Water in Pipes," p. 48, vol. 29.

V. T. asks: How can I make a fuse that will burn at the rate of about 200 feet per minute, and that will take fire at a temperature of about 150° or 200° Fah.? A. Consult the specifications of the recently patented fire alarms.

J. B. asks: How is a person affected by laughing gas? Is it injurious? How is it administered? A. Taken in moderate quantities, it exercises a strong influence upon the muscles which are brought into play when there is laughter: but in larger doses, of five gallons and upwards, it produces unconsciousness and insensibility to pain. When manufactured from pure nitrate of ammonia, and washed by passage through water, solution of green vitriol, and solution of potash, it may be taken without danger by persons in good health, if administered in a proper manner. It is breathed through a stopcock which admits the gas from the bag to the lungs, but sends the gas issuing from the lungs out into the atmosphere.

N. S. asks: 1. How can I seal the ends of small glass tubes? A. Use a blowpipe. 2. What is the process of silver plating? A. See pp. 299, 315, vol. 29.

E. C. M. asks: 1. Are the Cornwall (England) tin mines the only ones in the world? A. No. 2. Is it true that one has been discovered in California? A. Yes. For answers to your other questions see books on metallurgy, frequently advertised in our columns.

W. R. asks: 1. How many figures denote a billion, and how many a trillion? A. A billion is 1,000,000,000,000. A trillion is 1,000,000,000,000,000,000. 2. Has the earth two revolutions, one on its axis, the other round the sun? A. The earth rotates on its axis, and revolves round the sun. 3. Is the sun the center of the solar system? A. Yes. 4. Are the stars inhabited? A. Nobody knows. The approximate constitution and condition of many of the stars has been determined by the spectroscope, and the results show that none that have yet been examined present the conditions necessary to support human life. For example, our moon is found to be without water or air and intensely cold. Saturn and Jupiter are red hot. It is thought some of the moons of this planet may possibly be inhabited.

F. H. S. says: 1. I want to cast a small steam engine of brass: what is the composition that the founderies use to put in their flasks? Can I melt brass in a common stove? A. A good composition is 7 lbs. copper, 3 lbs. zinc, 2 lbs. tin. Probably you will find a forge better for the purpose. 2. How much power would an engine cylinder 1½x4 inches, with 10 lbs. of steam have, and also with 30 lbs.? A. See article on "Indicating Steam Engines," page 64, vol. 30. 3. Would a crank do instead of an eccentric for the slide valve? A. Yes. 4. Can you recommend me a good book on molding brass, and one on the steam engine? A. Byrne's 'Practical Metal Worker's Assistant," and Bourne's "Catechism of Steam the Engine." 5. How thick should a small boiler (about 2 feet x 1 foot) be to withstand a pressure of 10 lbs. and also one of 30 lbs.? How thick would brass have to be? A. Sufficient *data* not sent. 6. How does a steam gage tell the pressure in a boiler? Must the pipe leading to the gage be one inch? A. The gage is so graduated that a pressure of 1 lb. per square inch gives a corresponding indication. The size of the connecting pipe makes no difference.

G. N. K. says: We wish to heat a factory (30x80 feet and four stories high) with exhaust steam and are advised to put in 4 inch tin pipes, one tier in each room, painting those where the most heat is wanted some light color, and where less heat is wanted, a dark color. Will this answer as well as iron pipes? Why will the tin pipe radiate heat when painted? A. A tin or iron surface covered with lampblack radiates more heat than the plain metal. When coated with white lead, it radiates about the same amount of heat. Tin is a fair conductor of heat, having about one third of the conducting power of gold.

C. V. asks: If an engine crank pin suddenly breaks, thereby destroying the connection between piston and crankshaft, what will follow? A. The piston would strike against the cylinder head; and if the latter be not strong enough to resist the blow, it would be broken.

A. O. B. says: In answer to a correspondent, you say that "eyestones are not alive." I think so too, but would like to know why they move about when placed in strong vinegar. A. We suppose it is on account of the generation of carbonic acid. For answers to your other questions, see "Friction of Water in Pipes," p. 48, vol. 29.

E. says: I have a double acting engine of one nominal horse power, speed 300 revolutions per minute. What would be the proper width of belt to connect engine to line shaft? A. Probably about an inch.

W. H. G. asks: Why is it that oxygen and hydrogen, when mixed in certain proportions and ignited, explode? The product is water, but does not an expansion take place? A. When these gases unite, the volume of the combination is much less than the original volume of the gases; so that a vacuum is produced, into which air rushes with great rapidity.

P. C. T. asks: Will a leaden ball, if thrown into the sea, sink to the bottom? If not, why not? A. Yes. 2. What is the depth of the deepest sea soundings? A. About 30,000 feet.

H. T. L. asks: Is there any chemical compound that will unite with or dissolve the albumen on albumenized paper? A. If the albumen is that of the white of eggs, it may be dissolved in alcohol containing a little alkali in solution.

"Erfinder," St. Louis, Mo.—Please send your name and address.

P. W. L. says, in reply to the query: "Can the four roots of the following equations be obtained: $x^2+y=7$, and $y^2+x=11$?" Certainly they can, and are as follows: $x=2$ and $y=3$, or $x=3\cdot181812+$, and $y=-2\cdot805118+$

H. D. M. says, in answer to N. F. T., p. 123, vol. 30: It is the soot on the bottom of the kettle that prevents it from burning the hand. It will prevent it only for a short time, probably until N. L. T. thinks it quits boiling. A bright bottomed kettle will burn the instant it touches the hand.

E. says, in reply to M. who asked for a good metal for models: Melt 6 lbs. tea lead, ½ lb. tin, and ½ lb. antimony. This will be a good stiff metal.

E. S. says, in further explanation of the board question, propounded by D. M. A. (see p. 91, vol. 30): Let W and w equal the two widths. Then will $\left(\frac{W^2+w^2}{2}\right)^{\frac{1}{2}}$ = the width of the board at the dividing point. Application to your question: $\left(\frac{12^2+4^2}{2}\right)^{\frac{1}{2}}=(80)^{\frac{1}{2}}=8\cdot9442+$. This formula is simple, and applies to all cases.

MINERALS, ETC.—Specimens have been received from the following correspondents, and examined with the results stated:

J. A. S.—Rounded fragments of quartz, the one of a yellow color being ferruginous quartz.

J. C.—This product appears to be a fair specimen of lard. To determine whether it is adulterated or not will require a chemical analysis. Lard oil is a commercial product and burns well in lamps if the wick tube be kept cool. It is chiefly obtained as a secondary product in the manufacture of stearin.

S. B.—The shining particles are mica and are mixed with rounded fragments of quartz.

M. McK.—It is white sand of superior quality, and is useful for making glass.

COMMUNICATIONS RECEIVED.

The Editor of the SCIENTIFIC AMERICAN acknowledges, with much pleasure, the receipt of original papers and contributions upon the following subjects:

On Healing Wounds by Charcoal, etc. By P.

On American Inventions in Europe. By H. S.

On Pavements. By S. S.

On Detecting Gold and Silver in the Earth. By G.

On the Curvature of the Earth. By G.E.W.

On the Thousand Feet Tower. By E. C. M.

On American Silk Manufacture. By H.C.F.

Correspondents in different parts of the country ask: Where are cotton seed linters sold? Where can the seed and cuttings of sumac be obtained? Who sells machines for making broom handles? Who makes the best clothes wringer? Who makes waterproof gloves, for use in handling strong lyes, etc.? Who makes a cider press that will get four gallons of cider from a bushel of apples? Makers of the above articles will probably promote their interests by advertising, in reply, in the SCIENTIFIC AMERICAN.

Correspondents who write to ask the address of certain manufacturers, or where specified articles are to be had, also those having goods for sale, or who want to find partners, should send with their communications an amount sufficient to cover the cost of publication under the head of "Business and Personal," which is specially devoted to such enquiries.

[OFFICIAL.]

Index of Inventions

FOR WHICH

Letters Patent of the United States

WERE GRANTED IN THE WEEK ENDING

February 10, 1874,

AND EACH BEARING THAT DATE.

[Those marked (r) are reissued patents.]

Abdominal supporter, M. S. Larned	147,275
Air, navigating the, S. Francis	147,252
Air, cooling, J. Parisette	147,281
Axle clip, J. Ives	147,268
Ball car, P. Miles	147,343
Bale tie, J. W. Hedenberg	147,262
Bale tie, cotton, H. Estes	147,380
Bale tie, cotton, H. Estes	147,381
Bale tie, cotton, J. E. Lea	147,276
Barrel hoop, L. Reed	147,284
Basket, H. C. Jones	147,328
Basket former, A. F. Scow, (r)	5,757
Bed bottom, T. S. Judd	147,530
Bed bottom stretcher, H. D. Goldsmith	147,319
Bed, sofa, J. F. Birchard	147,359
Bell, sleigh, A. Harrison	147,259
Belt clamp, Minnich & Lobnes	147,419
Blackboard, F. G. Hunt	147,267
Blasting, G. Frisbee	147,154
Blasting plug, G. Frisbee	147,253
Boiler flue, steam, C. B. Stillwell	147,446
Boiler, sectional steam, J. Harrison, Jr.	147,391
Boiler, sectional steam, E. B. Jucket	147,405
Boiler, steam, M. W. Shapley	147,437
Boiler safety valve, E. F. Steele	147,292
Bolt threading machine, A. Wood	147,462
Book binding, C. S. Murphy	147,422
Boot heels, molding, Simonds & Emery	147,288
Boring machine, G. W. McCready	147,339
Bosom pad and protector, J. E. Hodgkins	147,264
Box for transporting eggs, etc., H. A. Knight	147,382
Box, letter, J. D. Stewart	147,445
Brush and mop holder, M. J. A. Keane	147,331
Brush, hat, F. Hickman	147,393
Brush, marking, E. W. Hitchings	147,394
Brush, tooth, J. G. La Fonte	147,410
Buckle, harness, B. D. Jessup	147,404
Buckle, suspender, H. A. House	147,325
Burial casket, M. M. & S. G. Hersman	147,263
Burner, gas, C. C. Bingham	147,234
Butter package, F. A. Lane	147,274
Can, oil, K. Kittoe	147,2
Car axle, G. W e timore	

Car brake, N. Kirchrath....147,407
Car brake, atmospheric, H. E. Marchand....147,416
Car brake, hydraulic, T. McBride....147,388
Car coupling, W. C. T. Davidson....147,309
Car coupling, J. X. Pease....147,428
Car coupling, W. Stiles....147,350
Car, dumping, C. C. P. Meyer....147,341
Car, street, C. M. Murch....147,421
Car fire extinguisher, W. L. Drake....147,248
Car water closet, Brown & Latimer....147,363
Carbureter, Davey & Griswold....147,244
Carbureter, J. Gray....147,256
Card, photographic visiting, T. T. Smith....147,289
Carriage, G. H. & E. Morgan, (r)....5,761
Carriage, child's, H. D. Ambler....147,354
Carriage curtain, A. H. Tuttlebee....147,450
Cartridge creasing implement, W. B. Hall....147,321
Casting seals, machine for, H. Holt....147,395
Chamber seat, G. H. Blair....147,360
Checks, etc., preventing alteration of, E. J. Fischer....147,382
Churn, rotary, C. M. Olphant....147,344
Cigar lighter, gas, H. Kruger....147,409
Clamp for mosquito net, W. M. White....147,298
Claw bar, D. Fernback....147,251
Cloth cutting machine, A. Warth....147,453
Cloth measuring machine, T. M. Brintnall....147,235
Cloth sponging machine, J. W. Dammerall....147,243
Clothes pin machine, H. & E. W. Locke....147,277
Coal, etc., loading, C. W. Hunt....147,400
Cock, etc., steam, J. P. Connell....147,240
Cotton gin, I. F. Brown....147,364
Dental plate and teeth, R. E. Burian....147,369
Digger, etc., quack, L. W. Dickerson....147,245
Disinfecting apparatus, J. D. C. Outwater....147,425
Dominoes, J. W. Hyatt, Jr., (r)....5,760
Door check, J. S. Ryan....147,434
Drill, rock, S. Ingersoll....147,402
Eaves trough hanger, Jones & Evans....147,329
Elevator, G. Lane....147,411
Engine for rock drills, etc., steam, S. Ingersoll, *et al.*....147,403
Explosive compound, C. Dittmar, (r)....5,759
Felting material from waste, J. F. Greene, (r)....5,763
Felting material from waste, J. F. Greene, (r)....5,764
Fence, S. B. Tinkham....147,449
Fire arm, breech loading, E. Whitney....147,457
Fire extinguisher, W. L. Drake....147,249
Fire extinguisher, chemical, J. H. Steiner....147,442
Fishing reel, C. W. MacCord....147,414
Fruit masher and sifter, C. S. Bucklin....147,304
Fruit picker, A. W. Overholser....147,426
Furnace, etc., E. S. Wheeler....147,456
Furnace, hot air, W. S. Stevenson....147,444
Furnace, tyre heating, Sax & Kear....147,287
Furnace, waste gas, P. L. Weimer....147,455
Furnace casing, J. Magee....147,277
Game board, Dahmer & Klein....147,376
Game board, O. H. Richmond....147,431
Gas cigar lighter, H. Kruger....147,409
Gate, automatic, W. W. Gilbert....147,318
Gearing, expansion, L. P. Hoyt....147,398
Glass letters, mold for, T. H. Banks....147,302
Goods on bias, cutting, G. Moore (r)....5,756
Grain for starch, etc., treating, Adams & Simonin....147,353
Grate and ash sifter, G. W. Pettit....147,347
Halls, preventing reverberation in, J. P. Taylor....147,294
Hammer, claw, D. W. Parker....147,427
Harness saddle, J. F. Knorr....147,408
Harvester, J. C. Crawford....147,242
Harvester, J. D. Martin....147,336
Harvester, binder attachment, W. C. Dentler....147,310
Harvester, binder platform, A. Elijah....147,378
Hasp fastener, W. H. Hart....147,260
Hog pen, P. Burke....147,306
Hog ringing pinchers, J. Burger....147,367
Hoop skirt, G. W. Hubbell....147,399
Horseshoe, J. Jorey....147,271
Horseshoes, bar for, Carruthers & Russell....147,371
Horseshoe for marshy ground, Milbury & King....147,342
Horseshoe nail machine, Whysall & Merrick....147,458
Horseshoes, calk for, G. McGregor....147,417
Hose coupling, E. B. Jucket....147,406
Indicator, station, D. H. Close....147,308
Ink in the form of paste, J. B. F. Jud....147,384
Inkstand, E. M. Dickinson....147,246
Jack, lifting, C. D. Smith....147,440
Knitting machine, T. Coltman....147,372
Lamp extinguisher, S. Stern....147,443
Latch, gate, C. Bartlow....147,237
Leather, etc., waterproofing, H. Martyn....147,337
Leather, stuffing, J. A. Enos....147,379
Leggings, G. M. Gernshyn....147,385
Lock, bag, J. L. Skinner....147,439
Lock cases, securing cap plates to, J. Hamill....147,258
Lock, permutation, J. G. O'Neill....147,345
Locomotive head light, T. S. Ray....147,283
Loom harness, T. Clegg....147,238
Loom weft stop, Isherwood & Nuttall....147,327
Lounge, extension, C. Streit....147,447
Marble, etc., removing stains from, H. H. Elliot....147,250
Mattress, T. Burdick....147,366
Metal fastening for leather, E. P. Richardson....147,430
Mill, grinding, Philippy & Elser....147,429
Mixing and sifting machine, M. Von Beast....147,296
Nut lock, A. B. Buell....147,305
Nut lock, S. T. Lamb....147,273
Oiler for machinery, O. H. Warren....147,452
Ore washer, D. Zeigler....147,464
Pail, dinner, E. Snape....147,290
Paper, machine for coloring, C. Wolmuth....147,300
Paper, corrugating, H. D. Cone....147,239
Peg cutting machine, Bacon & Sawyer....147,356
Pen, fountain, D. L. Latourette....147,338
Photographic visiting card, T. T. Smith....147,289
Pianoforte, C. E. Rogers....147,285
Piston rod adjuster, D. Bly (r)....5,758
Pitman, J. F. Setberling....147,436
Planers, feed roller for, L. P. Hoyt....147,397
Planter, corn, R. S. Hasen, Sr....147,392
Plow, J. C. Bidwell....147,283
Plow, wheel, I. B. Green....147,320
Pot, coffee, W. S. Bisisdell....147,361
Pot tilter, J. Grant....147,255
Potatoes, assorting, D. A. & A. B. Banker....147,301
Press, J. W. Fields....147,317
Press, cotton, M. Hussey....147,326
Printing press, reciprocating, J. F. Hallenbeck....147,257
Privy house, J. Holt....147,266
Pulverizer, J. Ferguson....147,316
Purifier, middlings, M. T. Greenleaf....147,388
Railway rail joint, A. Johnson....147,270
Railway signal, Hopkins & Norton....147,396
Railway ticket cutter, J. Tregurtha....147,295
Railway ticket holder, etc., J. K. Macdonald....147,278
Railways, removing snow from, W. Bush....147,307
Rake, horse hay, A. Rickart....147,432
Razor strops, paste for, C. M. Egbert....147,315
Register, etc., hot air, W. G. Creamer....147,374
Revenue, stills to prevent frauds on, L. Weill....147,299
Roof plate, T. Hyatt....147,401
Rubber spring for stirrups, F. Crane....147,373
Sash pulley, A. Halliday....147,322
Saw, C. D. Lathrop....147,335
Saw gummer, G. Mitchell....147,420
Saws, riveting teeth of, C. N. Brown....147,236
Sawing machine, G. S. Grier....147,389
Sawing machine, G. S. Grier....147,390
Scales, beam for weighing, J. Foller....147,383
Scraper, ice snow, H. Little....147,334
Scraper, road, W. C. Rose....147,433
Screen, revolving, J. Burns....147,370
Screws, making metal, C. M. Spencer....147,291
Sewing machine, E. A. Goodes....147,387
Sewing machine caster, G. W. Eddy....147,377
Sewing machine ruffler, C. M. Woolworth....147,463
Sewing machine treadle, W. I. Mann....147,413
Sewing machine trimmer, W. A. Springer....147,441
Sharpening machine, F. White....147,297
Silver, etc., from lead, separating, Webster *et al*....147,454
Soap, manufacture of, H. S. Lesher....147,418
Soap, etc., mixing, C. Lehmann....147,412
Soda water fountain, F. W. Wiesebrock....147,459
Spike machine, T. H. Johns....147,269
Spokes to fellies, fitting, G. Sweet....147,293
Spring, upholstery, E. Drake....147,247
Steam trap, J. Roper....147,286
Stone, artificial, J. McLean....147,418
Stove, lamp, W. L. Gibson....147,386
Stove pipe, C. H. Holmes....147,265
Swine, nose jewel for, J. Burger....147,368
Tank for asphaltic cement, T. New....147,428
Telegraph apparatus, H. Van Hoevenburgh....147,352
Telegraph, chemical, T. A. Edison....147,313
Telegraph, electric, T. A. Edison....147,311
Telegraph, circuit, T. A. Edison....147,314
Telegraph perforator, T. A. Edison....147,312
Toy propeller, W. Sellers (r)....5,752
Toy propeller, H. Thomas....147,448
Trap, animal, J. C. Maloy....147,280
Trap, hog, Peggs *et al*....147,346
Trowel, W. S. Haseltine....147,261
Vault cover, T. Sharts....147,438
Vault, fireproof, C. H. Schnelle....147,435
Vehicle, lamp support, T. Boudren....147,362
Vehicle, running gear, W. Hemme....147,324
Vehicle, sand band, J. Ross....147,349
Wagon rack, J. Bolt....147,308
Wagon running gear, P. B. Cunningham....147,375
Wash board, F. Voegtli....147,451
Washing machine, P. Berard....147,358
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Water wheel, J. Tyler....147,381
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Windmill, Althouse *et al*....147,352
Windmill, S. Pratt....147,285
Window frame, Oppendick *et al*....147,424
Wrench, bung bush, G. B. Cornell....147,241

APPLICATIONS FOR EXTENSIONS.

Applications have been duly filed and are now pending for the extension of the following Letters Patent. Hearings upon the respective applications are appointed for the days hereinafter mentioned:

28,335.—SMOKE COMBUSTION.—D. H. Williams. April 29.
28,372.—PLOW.—J. S. Huggins. May 6.
28,517.—CATTLE CAR.—L. Swearingen. May 13.

EXTENSIONS GRANTED.

27,094.—CARTRIDGE CASE MACHINE.—E. Allen.
27,179.—MARKING GAGE.—C. D. Wheeler.
27,139.—HANGING RUDDER.—J. P. Manton *et al.*

DISCLAIMER.

27,094.—CARTRIDGE CASE MACHINE.—E. Allen.

DESIGNS PATENTED.

7,159.—LABEL.—U. D. Manville, New Haven, Ct.
7,158, 7,161, and 7,162.—LAMP PEDESTALS.—N. L. Bradley, Meriden, Conn.
7,163.—CARPET.—J. Forrester, Kidderminster, England.
7,164.—WATCH CHARM., ETC.—A. Huffnagle, Phila., Pa.
7,165.—BILLIARD TABLE.—F. E. Held, Chicago, Ill.
7,166.—STREET CAR.—C. M. Murch, Cincinnati, O.
7,167.—MEDAL.—W. R. Nichols *et al*, Philadelphia, Pa.

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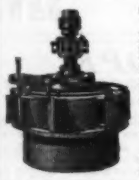

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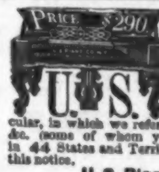

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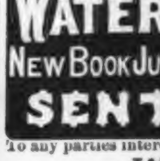

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THE "Scientific American" is printed with CHAS. ENEU JOHNSON & CO.'s INK. Tenth and Lombard sts. Philadelphia and 59 Gold st., New York